

The Links Between Student Attitudes, Engagement, and Learning in Introductory Data Science Courses



Hannah Lloyd



Erik Brockbank



Zoe Tait



Adam Bear

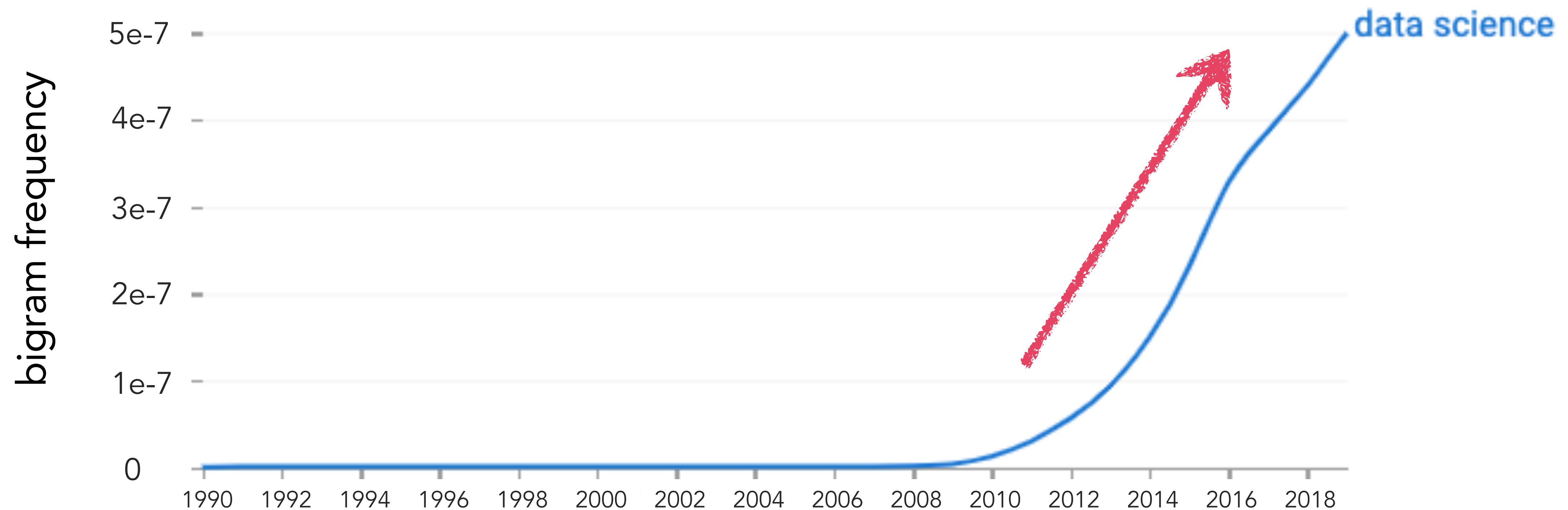


Soohyun Liao



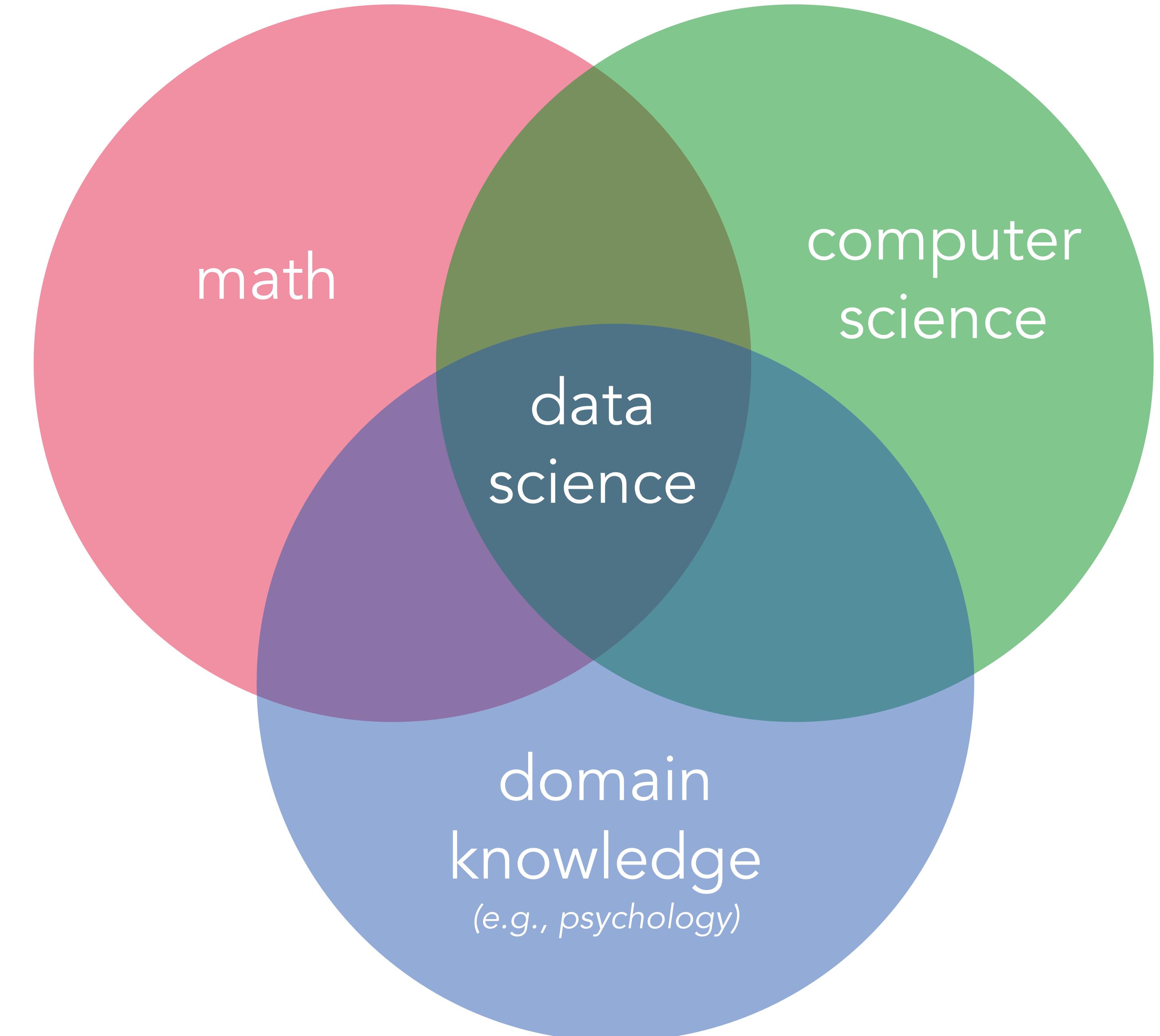
Judy Fan

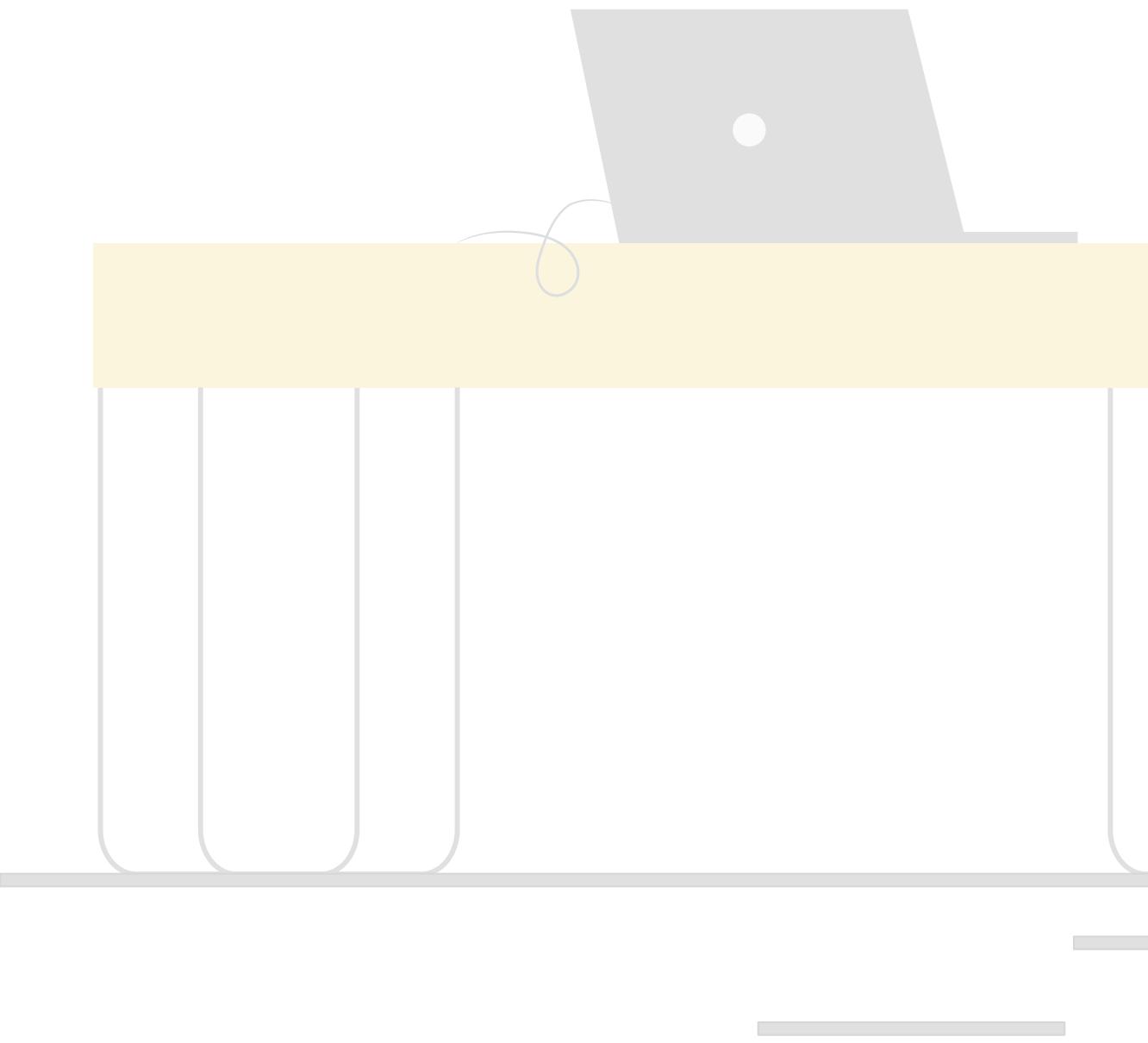
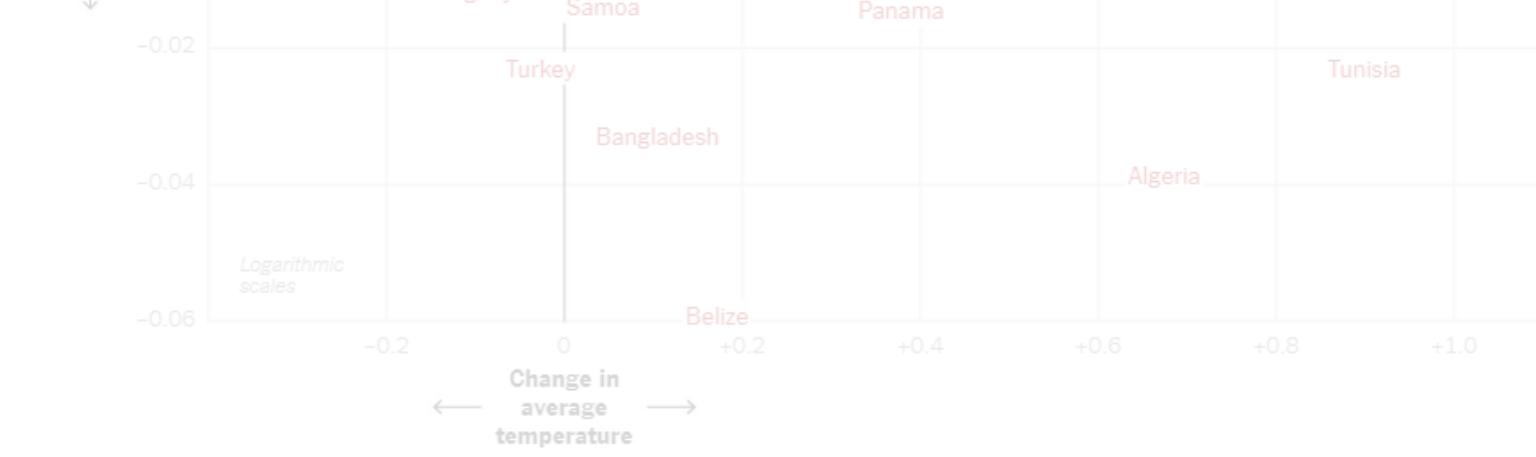
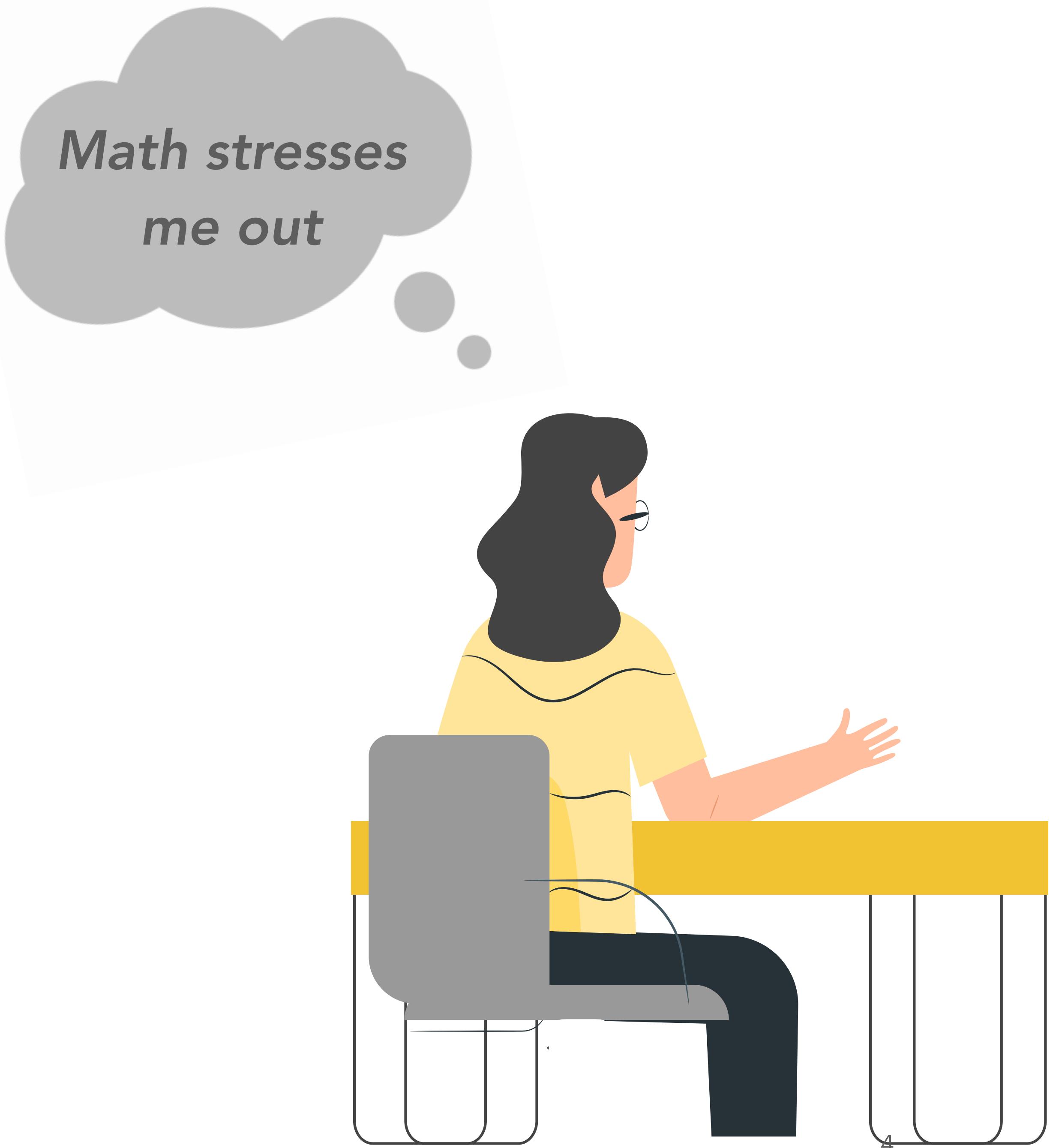
Rapid and recent rise in prominence of **data science**

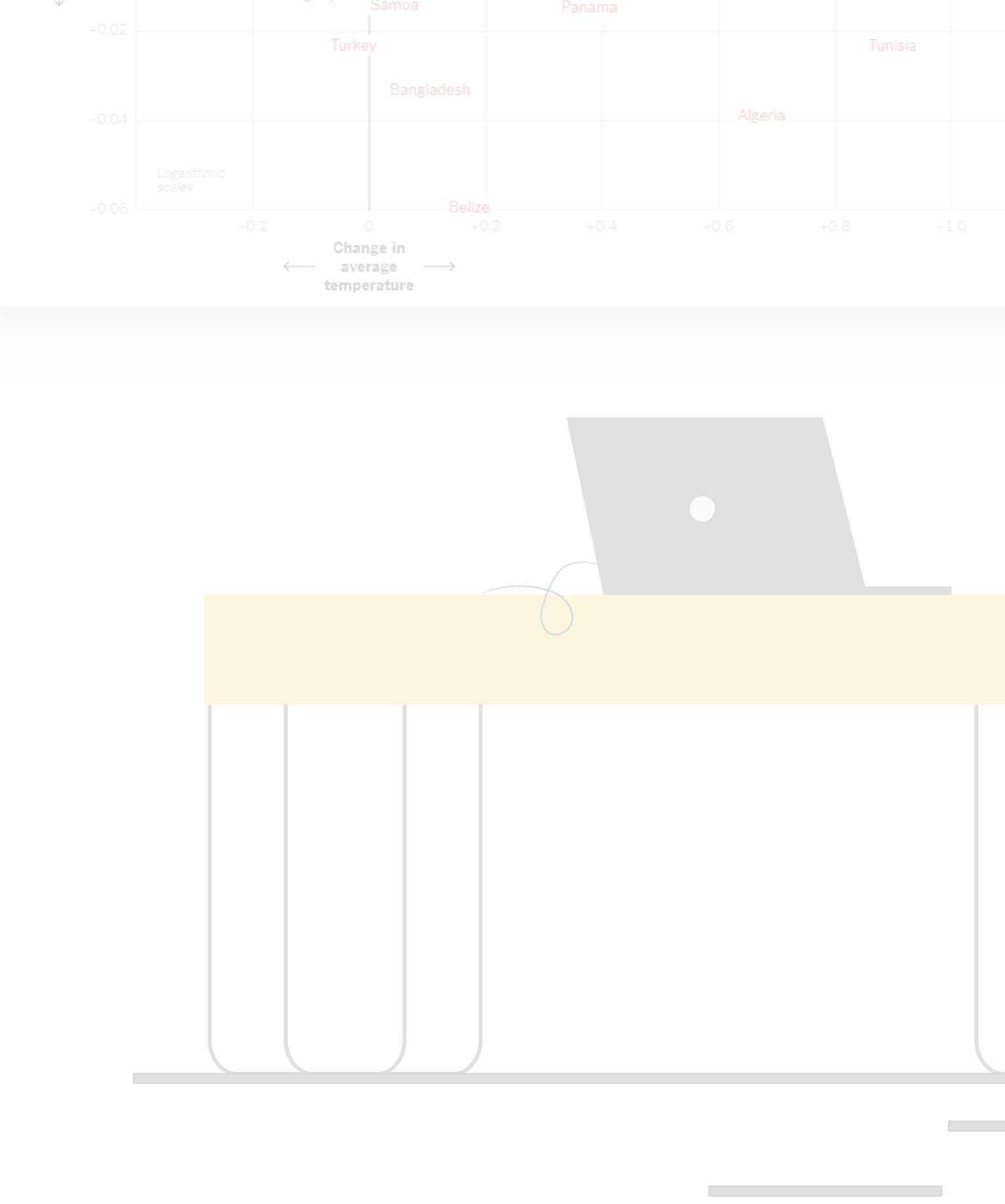
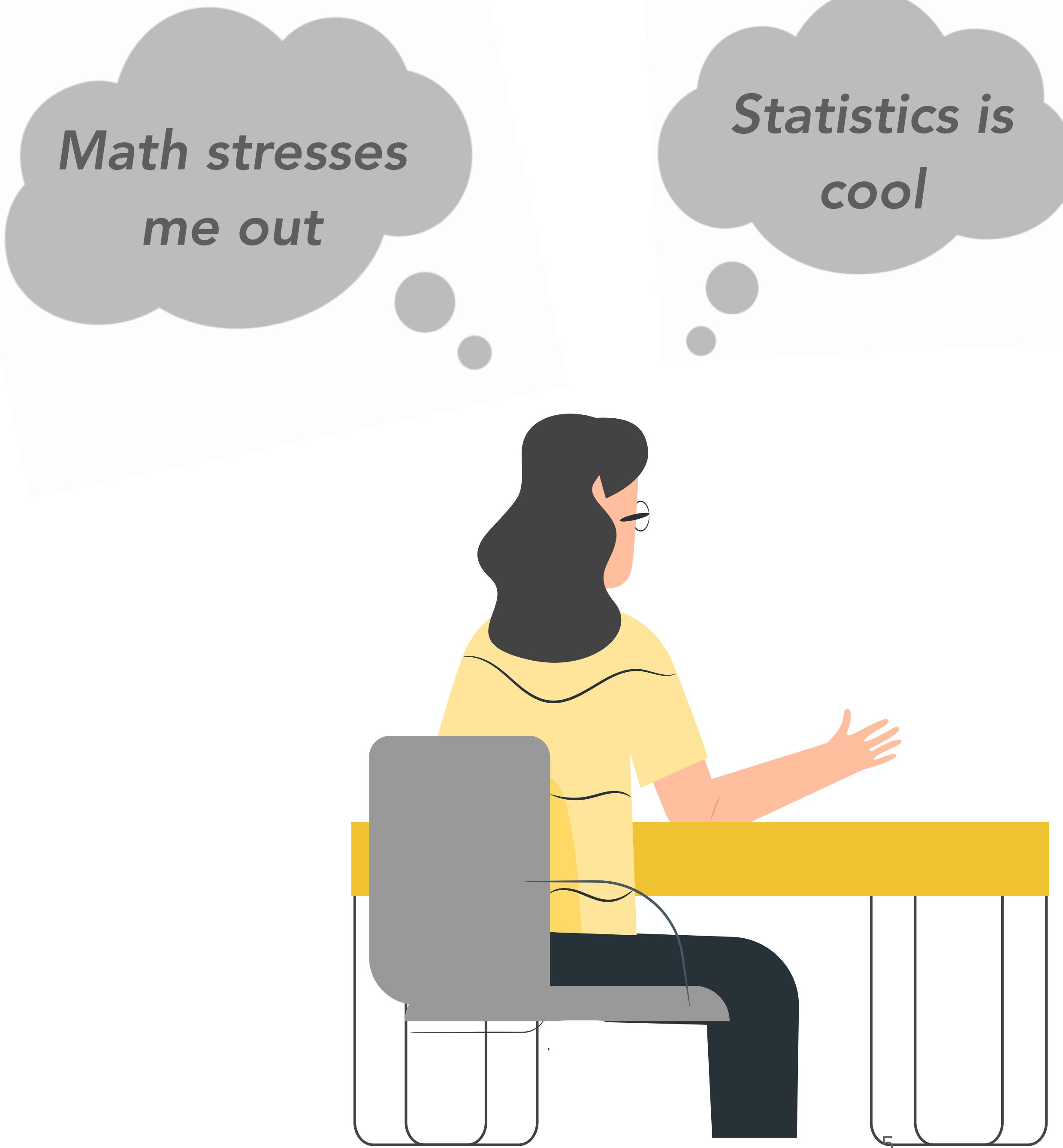


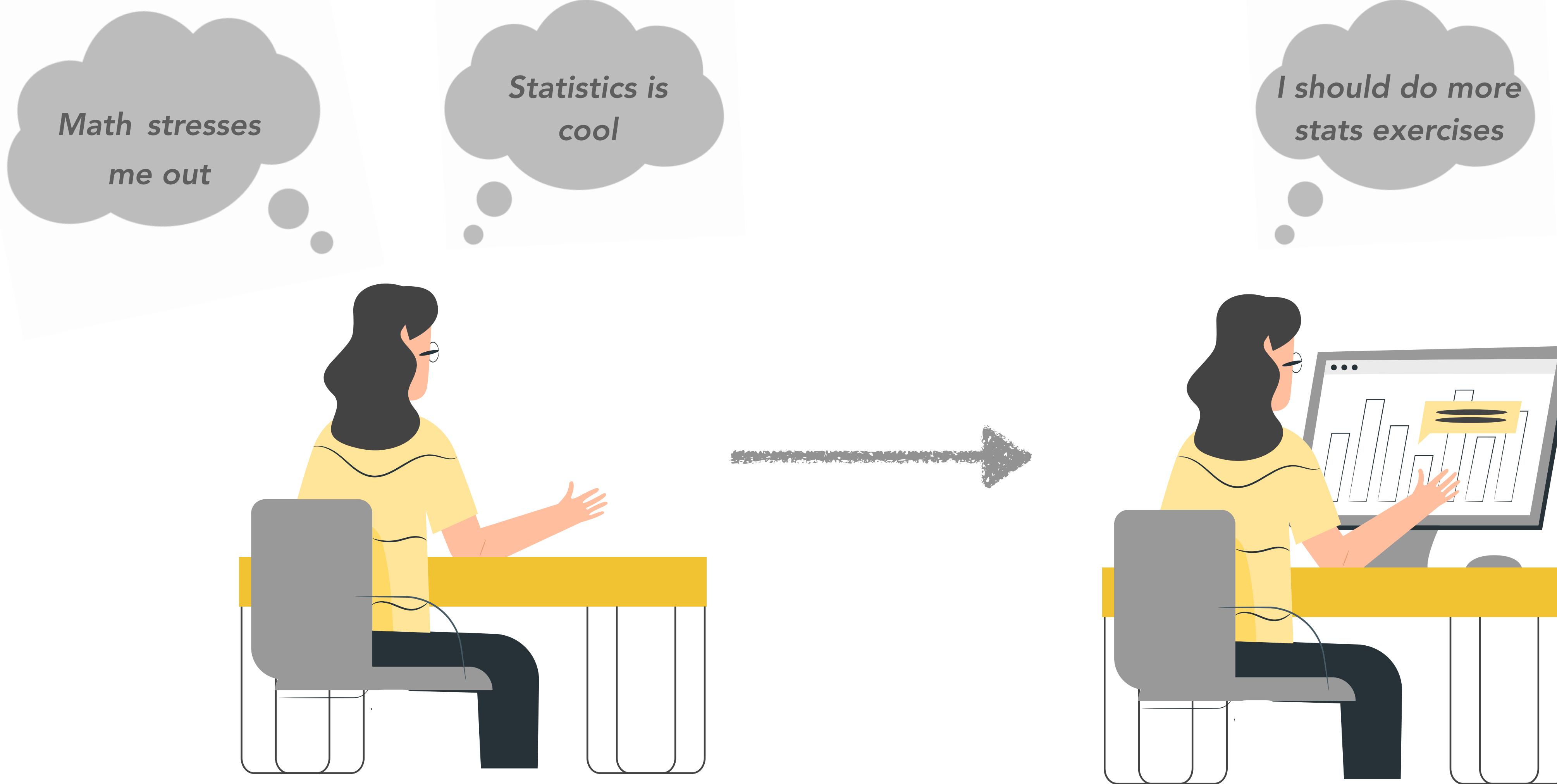
source: Google Books N-gram viewer

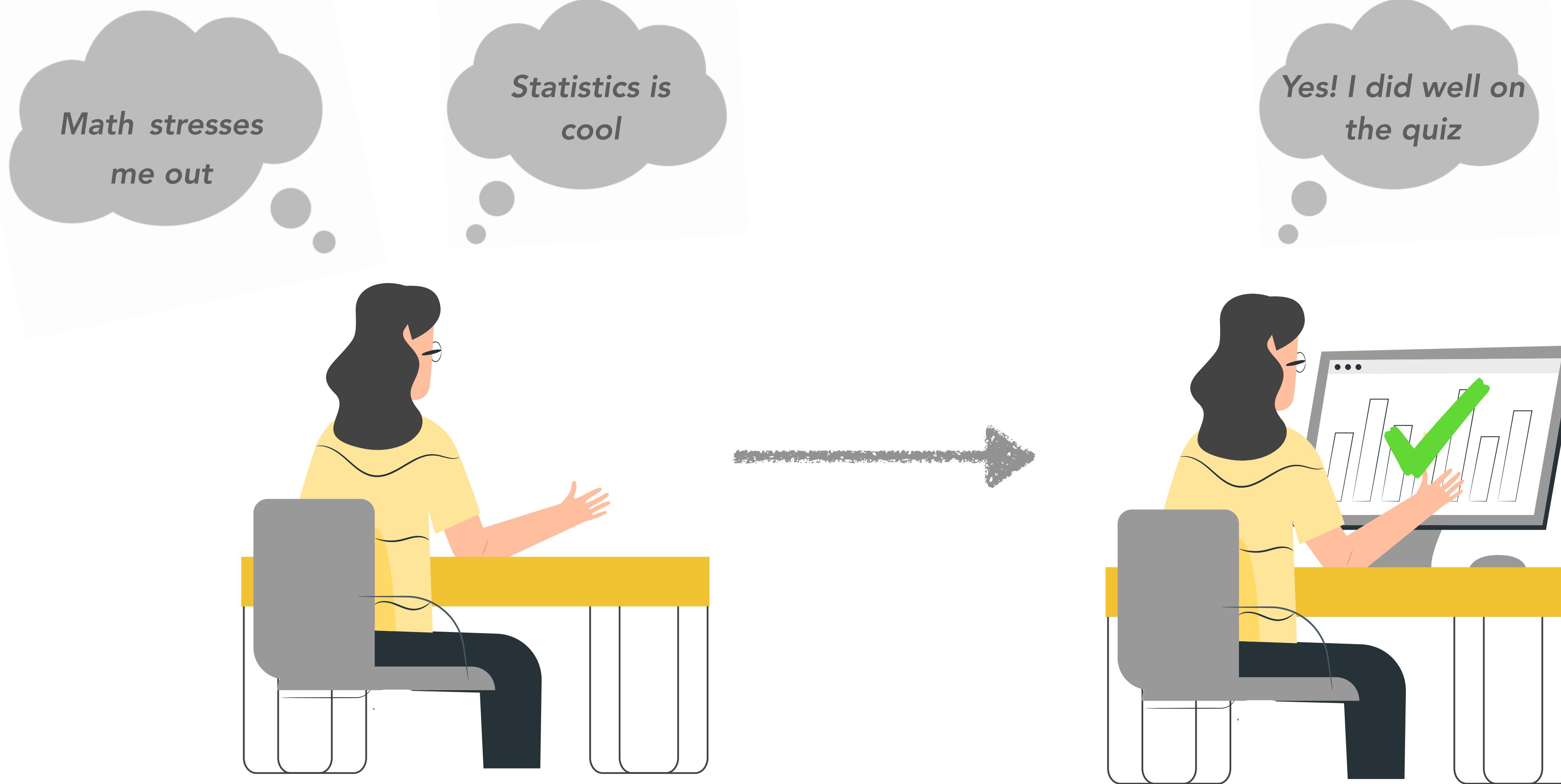
Multidisciplinarity
of data science
poses challenges
for pedagogy



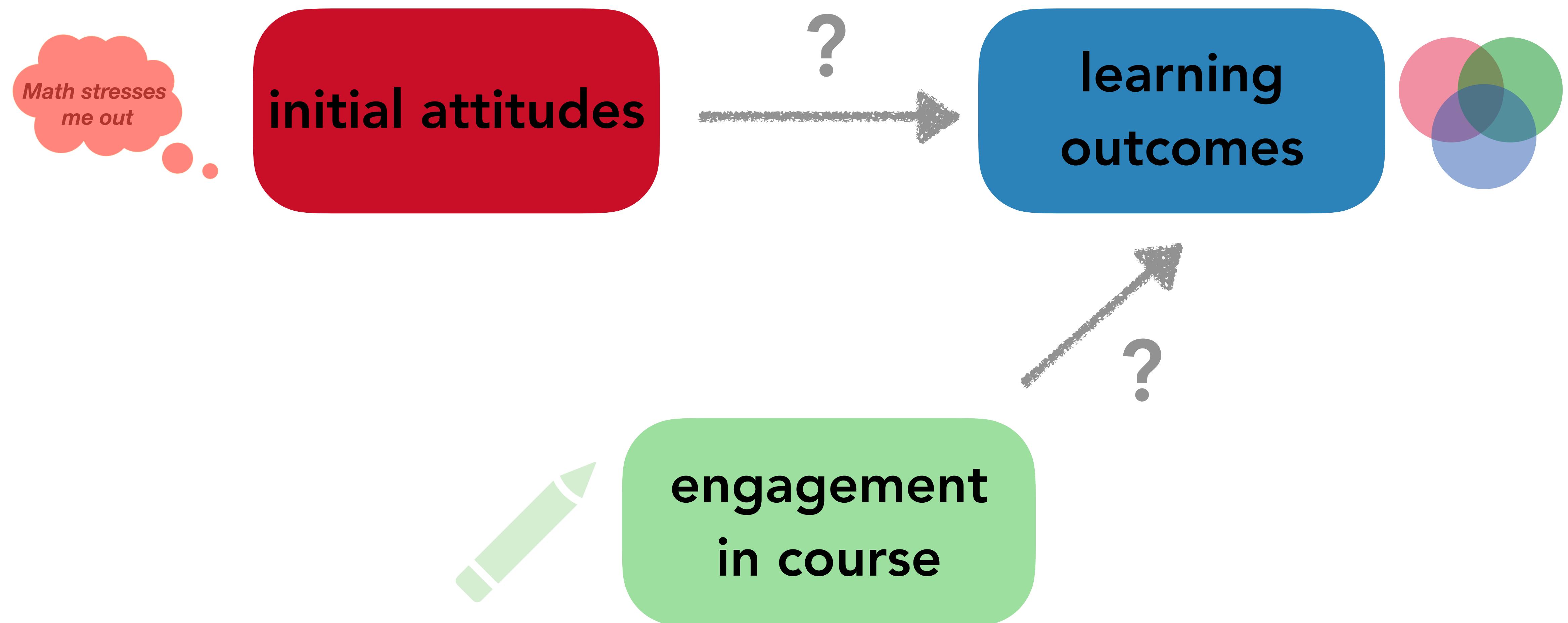




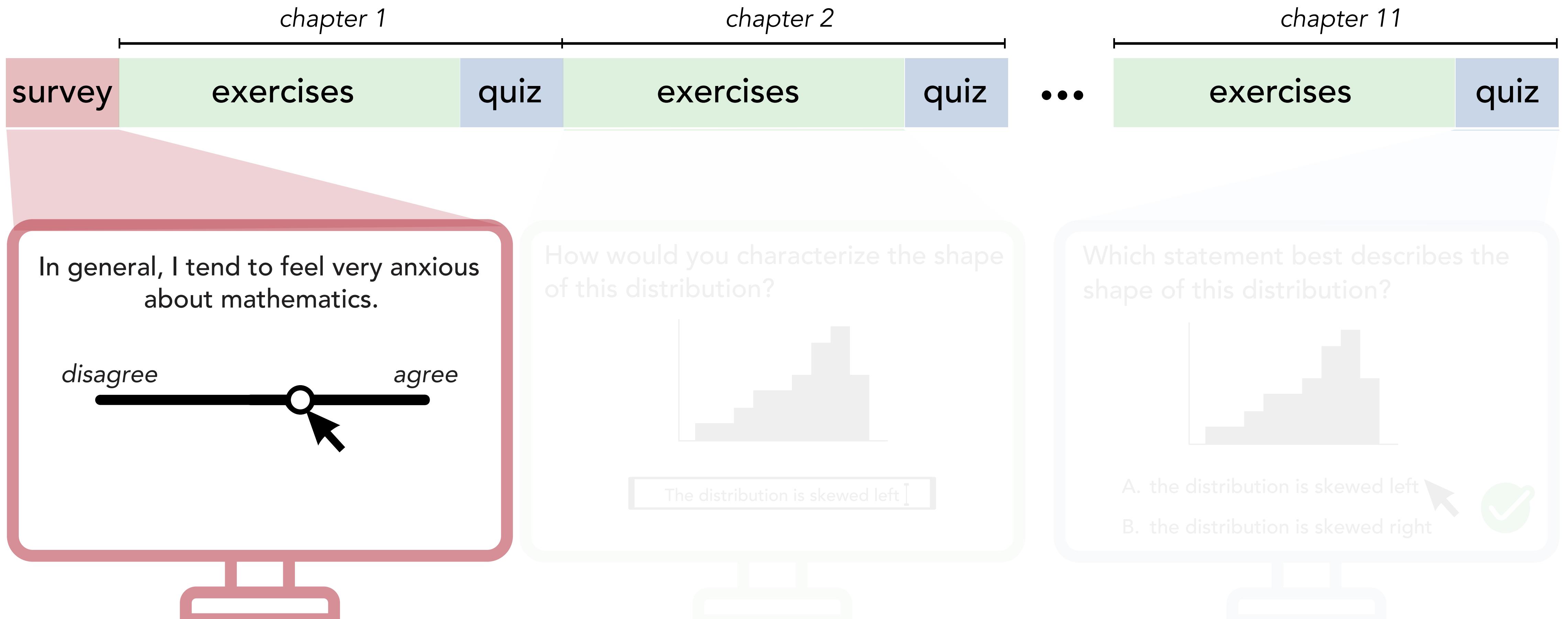




How well do student **attitudes** & **engagement** predict **learning**?



Measuring student attitudes & behavior using CourseKata



N = 3,642

Measuring student attitudes & behavior using CourseKata

example survey item	target construct
I will have to give up a lot to do well in this class.	expected level of sacrifice
My math ability is something about me that I can't change .	fixed mindset
In general, I tend to feel very anxious about math .	math anxiety
I expect this course will require a lot of memorization .	memorization
My grades in this class will improve my career .	impact on career
I think this class will be interesting .	interest in course
I think statistics and data science are interesting .	interest in topic
Have you had experience with computer programming before?	programming experience
Performing well in this class is important to me.	motivation to succeed
I expect to do well in this class.	expectation to succeed
How well have you done in mathematics courses ... in the past?	prior math performance

Measuring student attitudes & behavior using CourseKata

example survey item	target construct
I will have to give up a lot to do well in this class.	expected level of sacrifice
My math ability is something about me that I can't change .	fixed mindset
In general, I tend to feel very anxious about math .	math anxiety
I expect this course will require a lot of memorization .	memorization
My grades in this class will improve my career .	impact on career
I think this class will be interesting .	interest in course
I think statistics and data science are interesting .	interest in topic
Have you had experience with computer programming before?	programming experience
Performing well in this class is important to me.	motivation to succeed
I expect to do well in this class.	expectation to succeed
How well have you done in mathematics courses ... in the past?	prior math performance

Measuring student attitudes & behavior using CourseKata

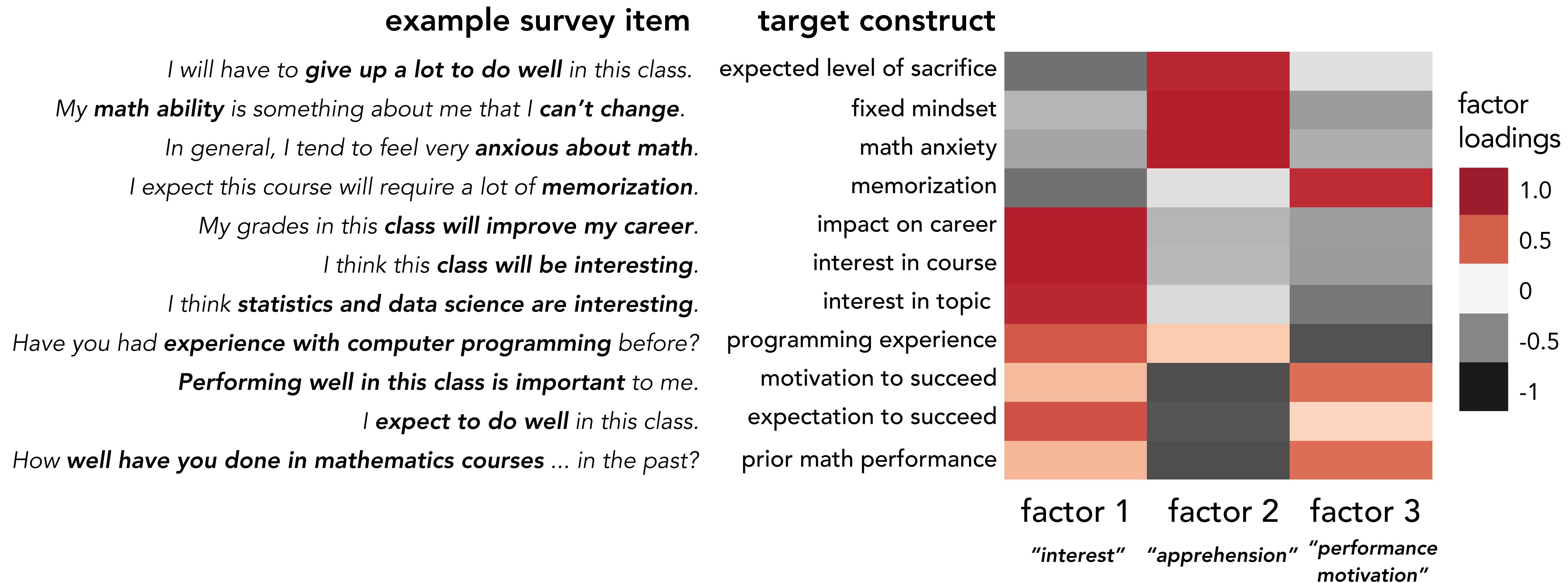
example survey item	target construct
I will have to give up a lot to do well in this class.	expected level of sacrifice
My math ability is something about me that I can't change .	fixed mindset
In general, I tend to feel very anxious about math .	math anxiety
I expect this course will require a lot of memorization .	memorization
My grades in this class will improve my career .	impact on career
I think this class will be interesting .	interest in course
I think statistics and data science are interesting .	interest in topic
Have you had experience with computer programming before?	programming experience
Performing well in this class is important to me.	motivation to succeed
I expect to do well in this class.	expectation to succeed
How well have you done in mathematics courses ... in the past?	prior math performance

Measuring student attitudes & behavior using CourseKata

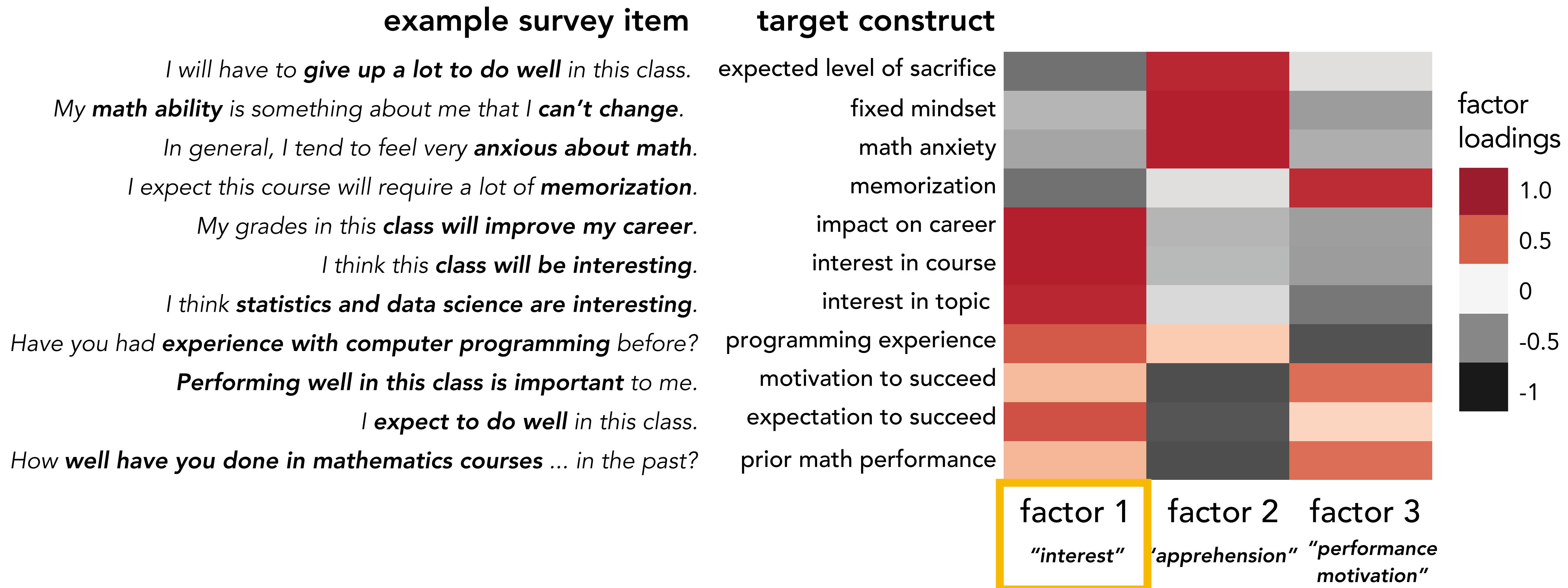
example survey item	target construct	factor loadings
I will have to give up a lot to do well in this class.	expected level of sacrifice	 1.0
My math ability is something about me that I can't change .	fixed mindset	0.5
In general, I tend to feel very anxious about math .	math anxiety	0
I expect this course will require a lot of memorization .	memorization	-0.5
My grades in this class will improve my career .	impact on career	-1
I think this class will be interesting .	interest in course	
I think statistics and data science are interesting .	interest in topic	
Have you had experience with computer programming before?	programming experience	
Performing well in this class is important to me.	motivation to succeed	
I expect to do well in this class.	expectation to succeed	
How well have you done in mathematics courses ... in the past?	prior math performance	

factor 1 factor 2 factor 3
"interest" "apprehension" "performance motivation"

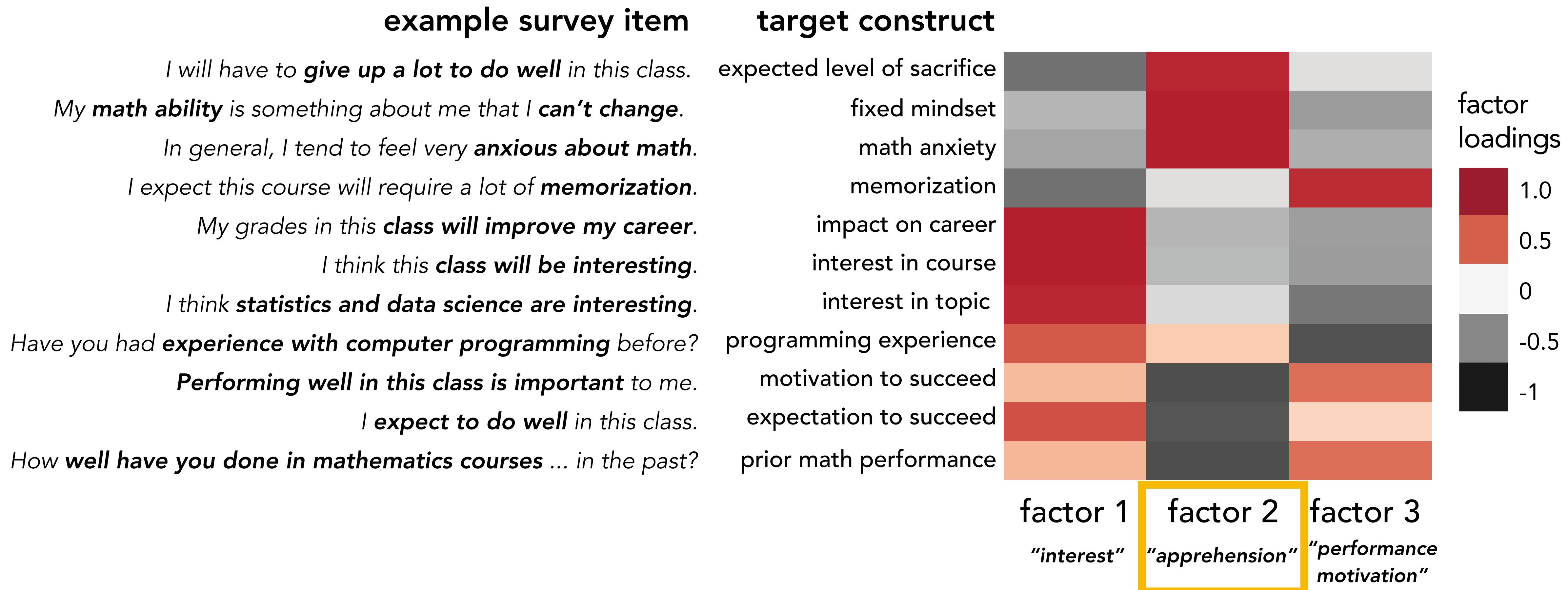
Measuring student attitudes & behavior using CourseKata



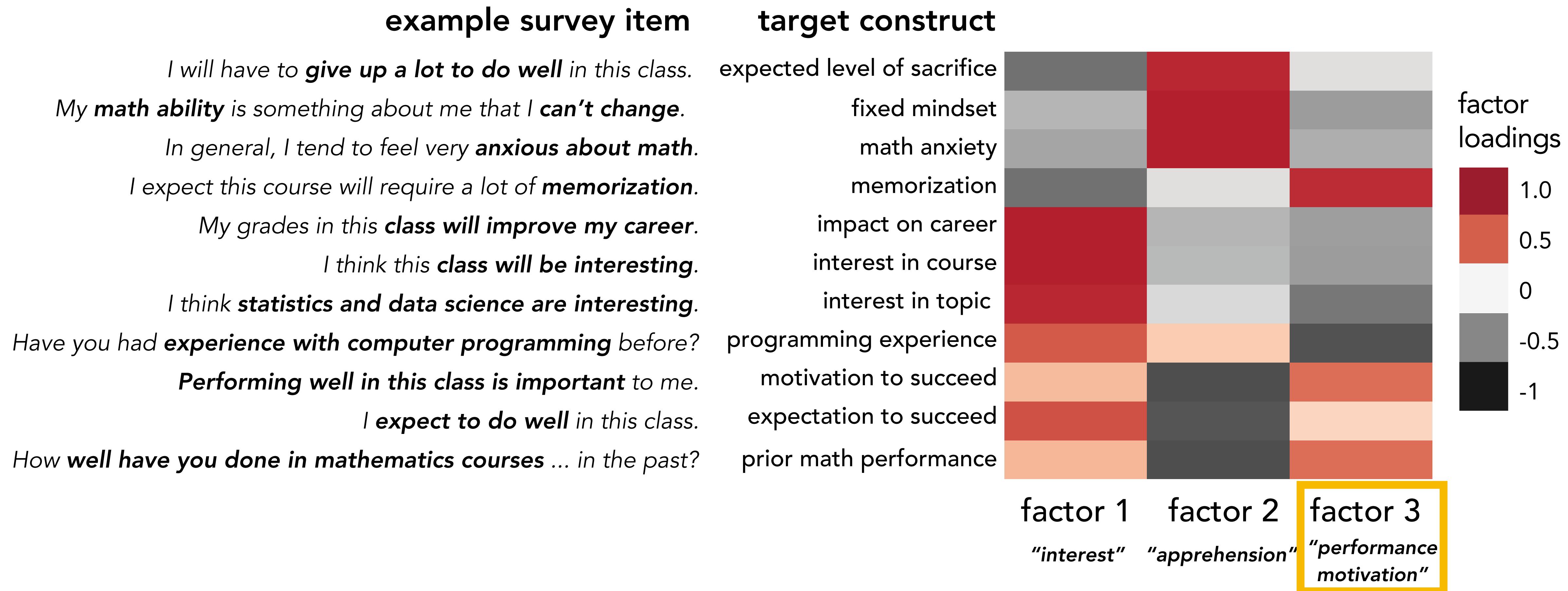
Measuring student attitudes & behavior using CourseKata



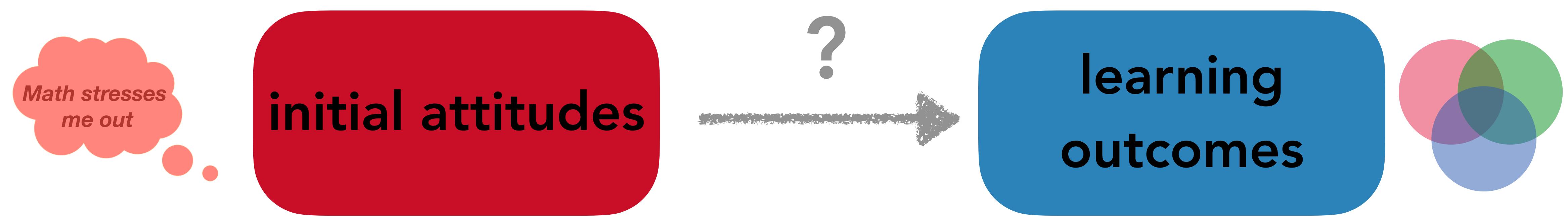
Measuring student attitudes & behavior using CourseKata



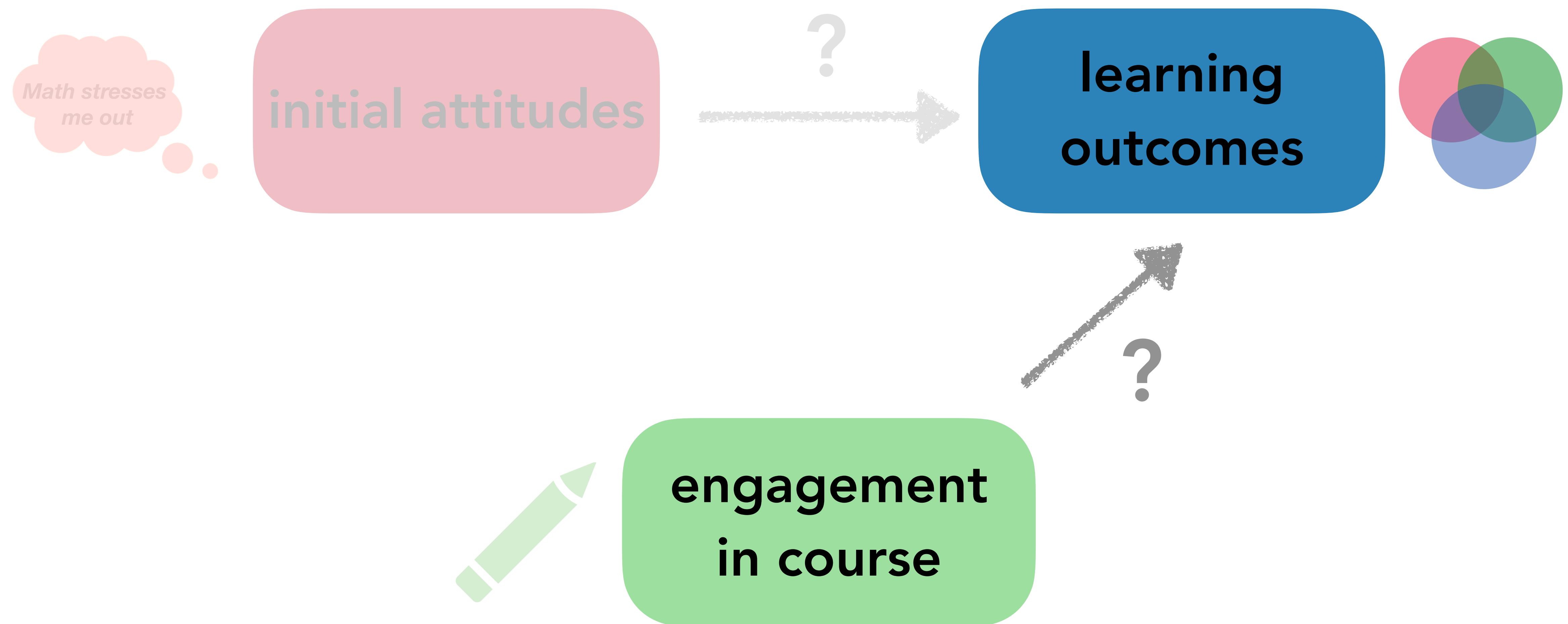
Measuring student attitudes & behavior using CourseKata



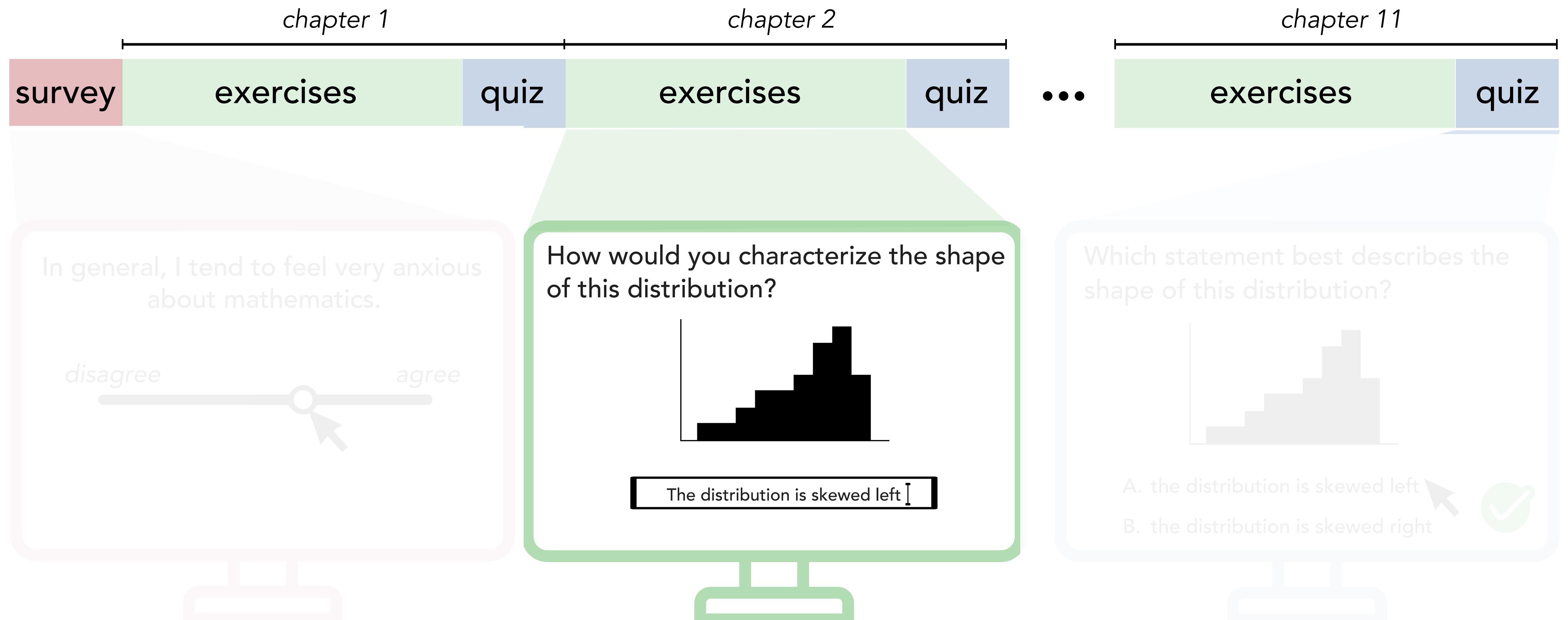
Measuring student attitudes & behavior using CourseKata



Measuring student attitudes & behavior using CourseKata

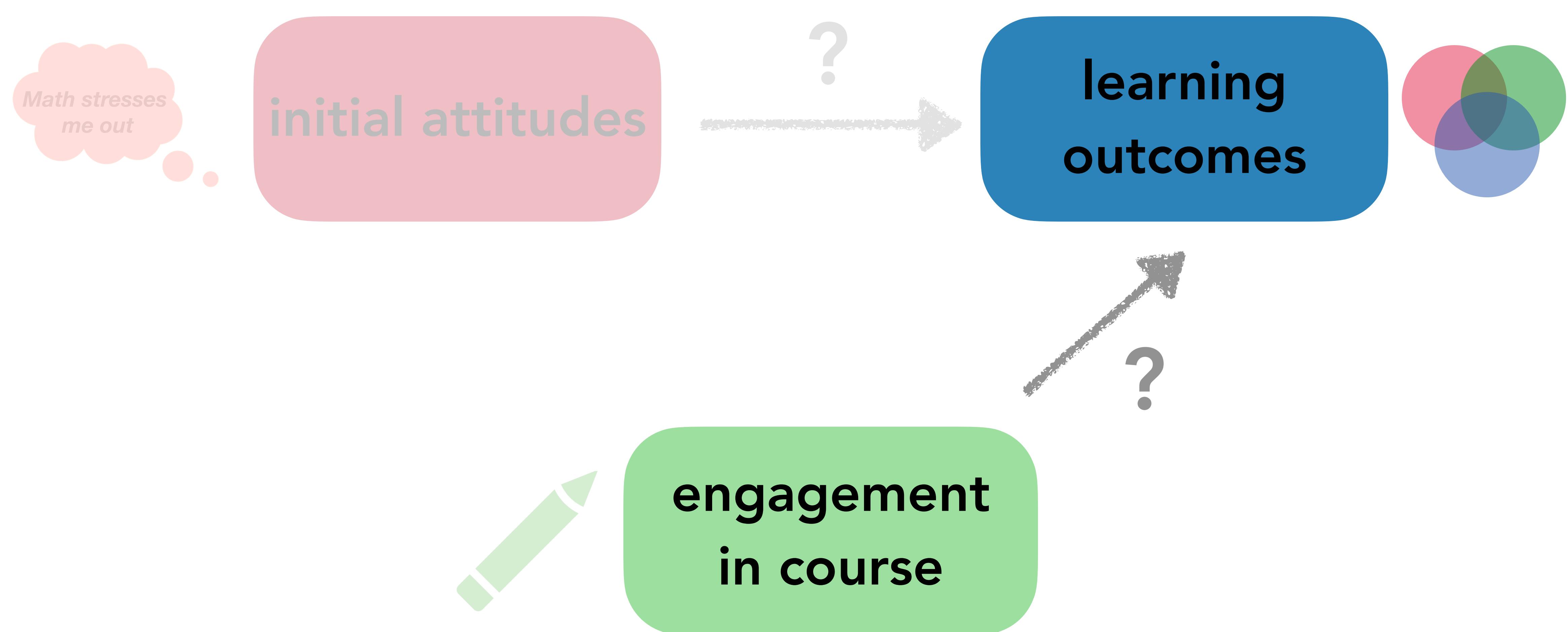


Measuring student attitudes & behavior using CourseKata

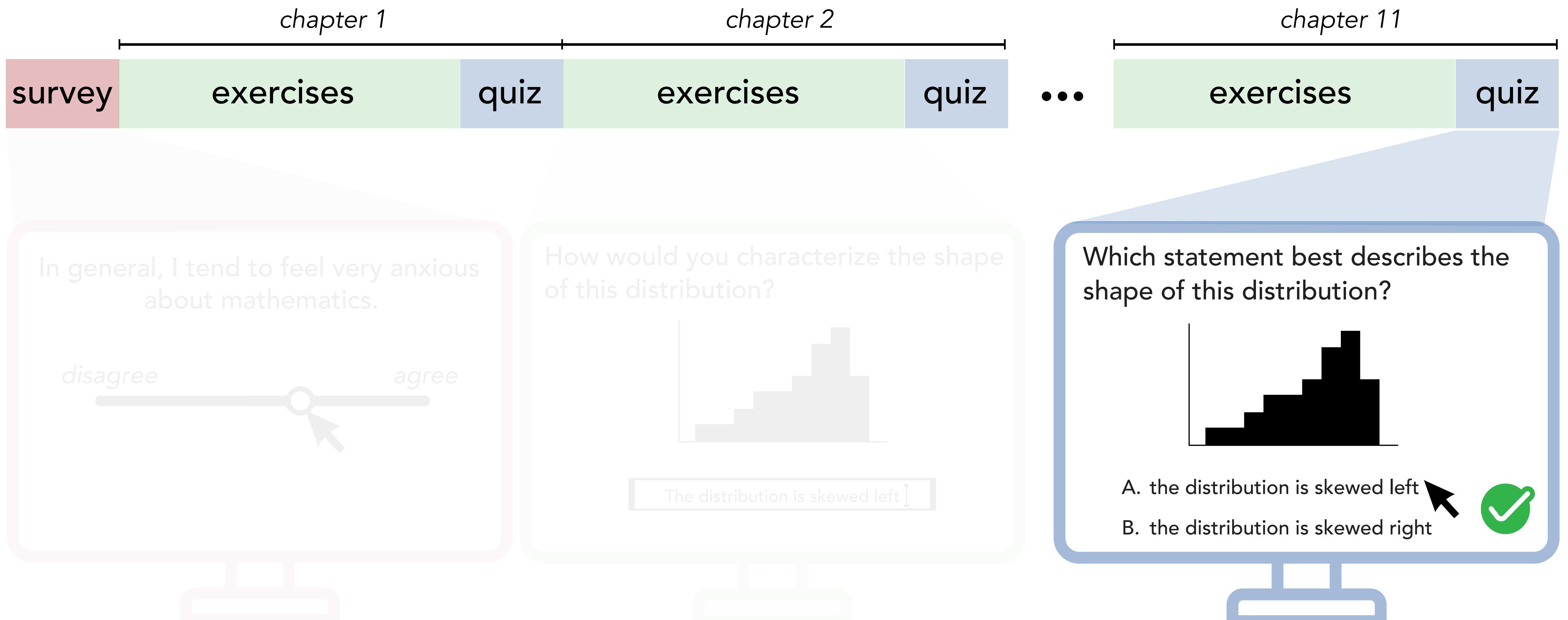


N = 3,642

Measuring student attitudes & behavior using CourseKata

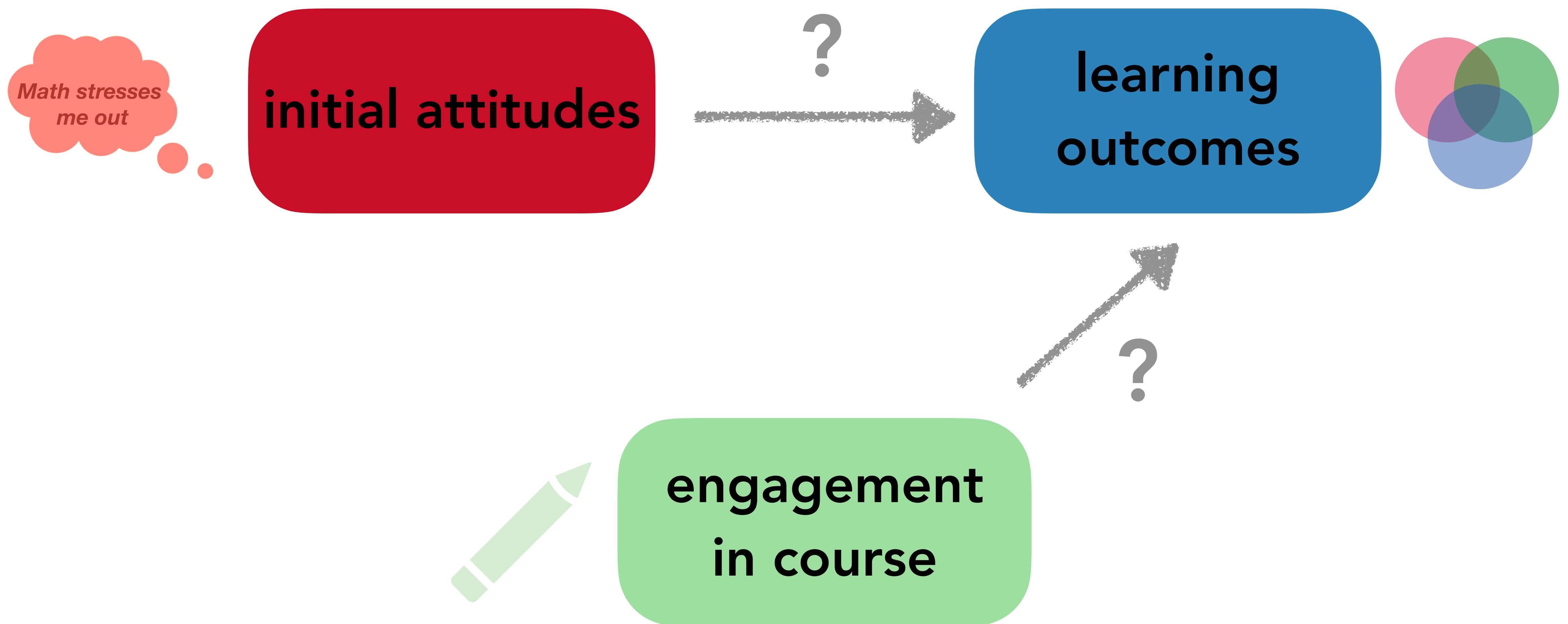


Measuring student attitudes & behavior using CourseKata

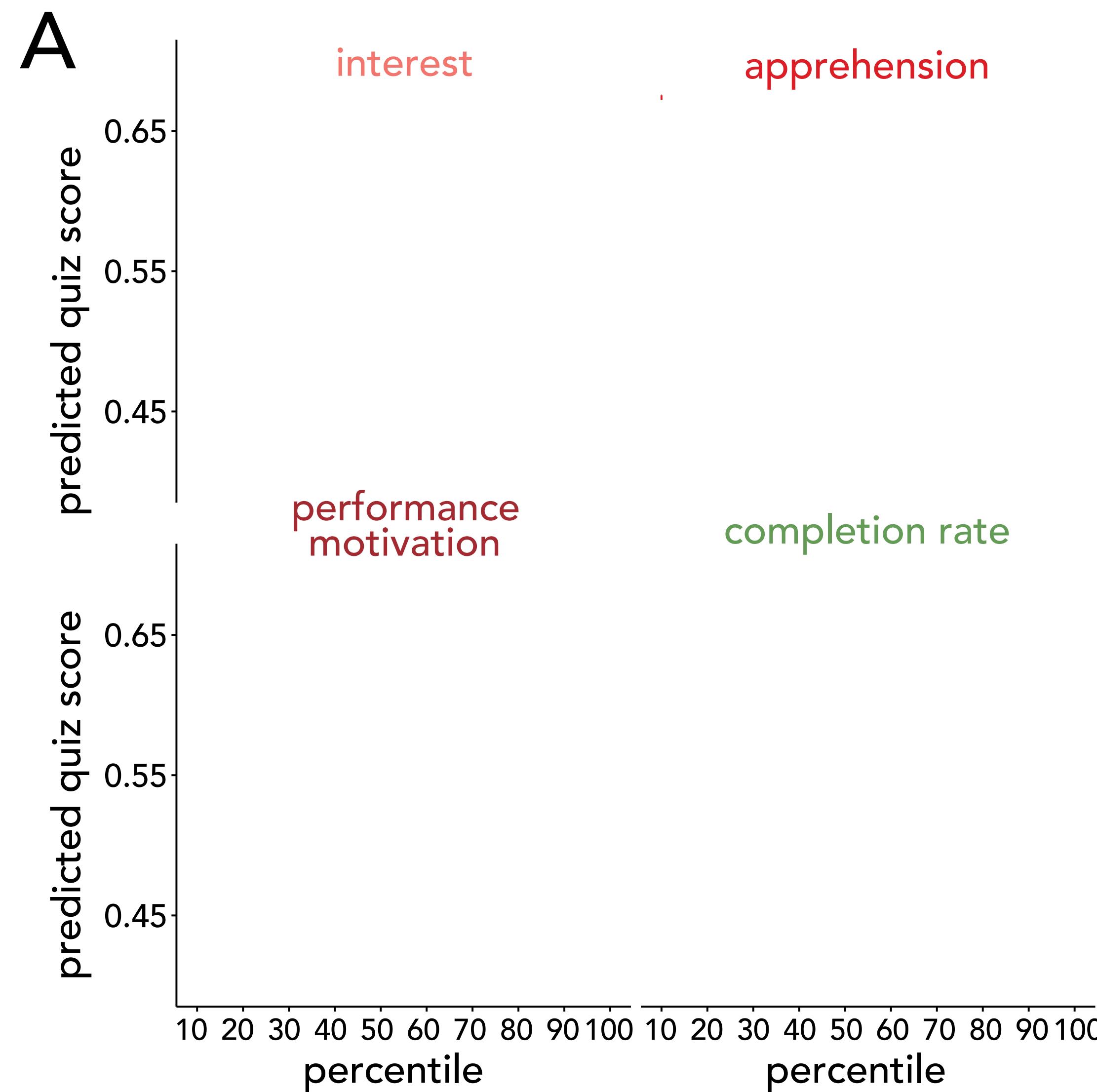


N = 3,642

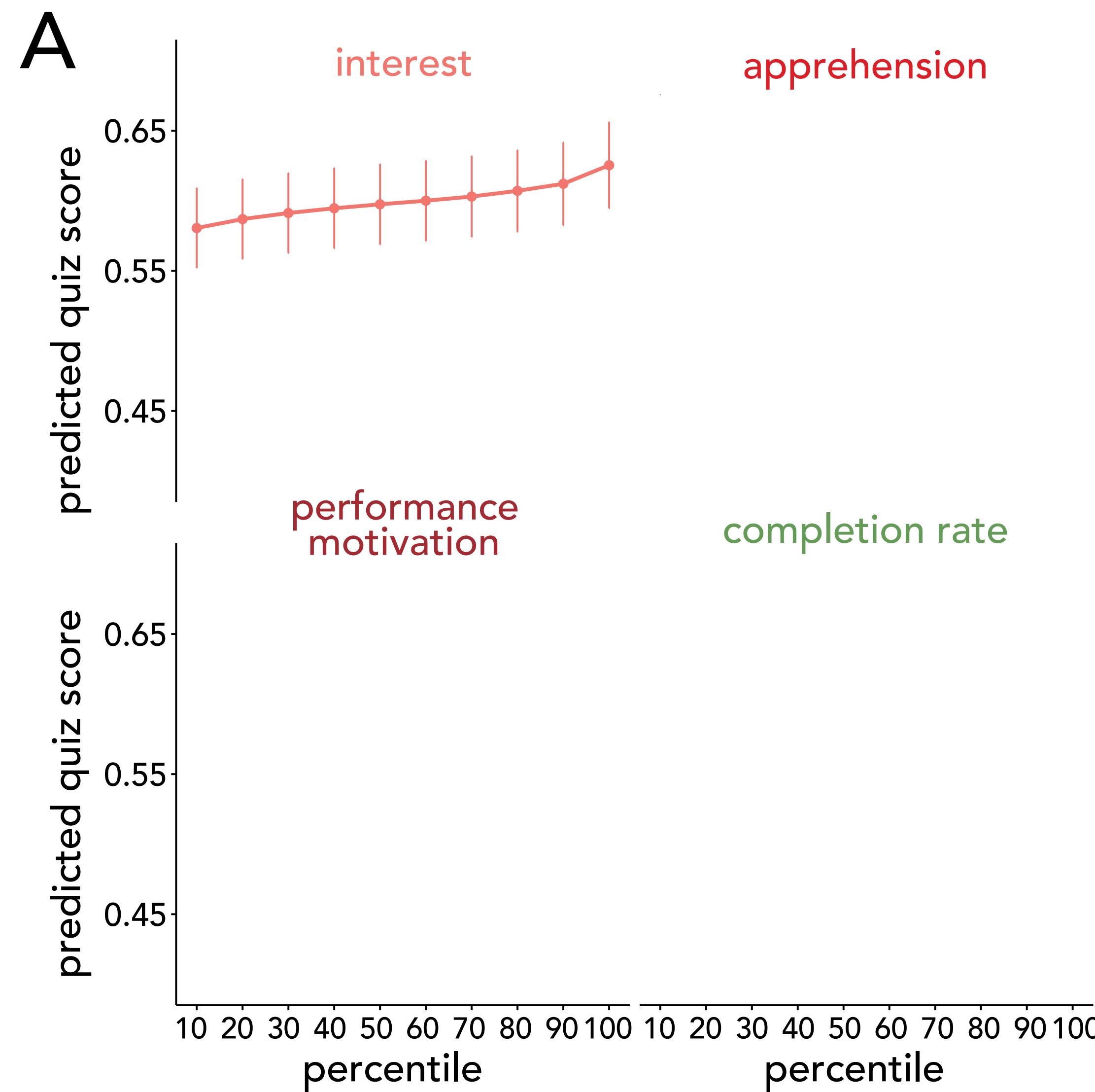
How well do student **attitudes** & **engagement** predict learning?



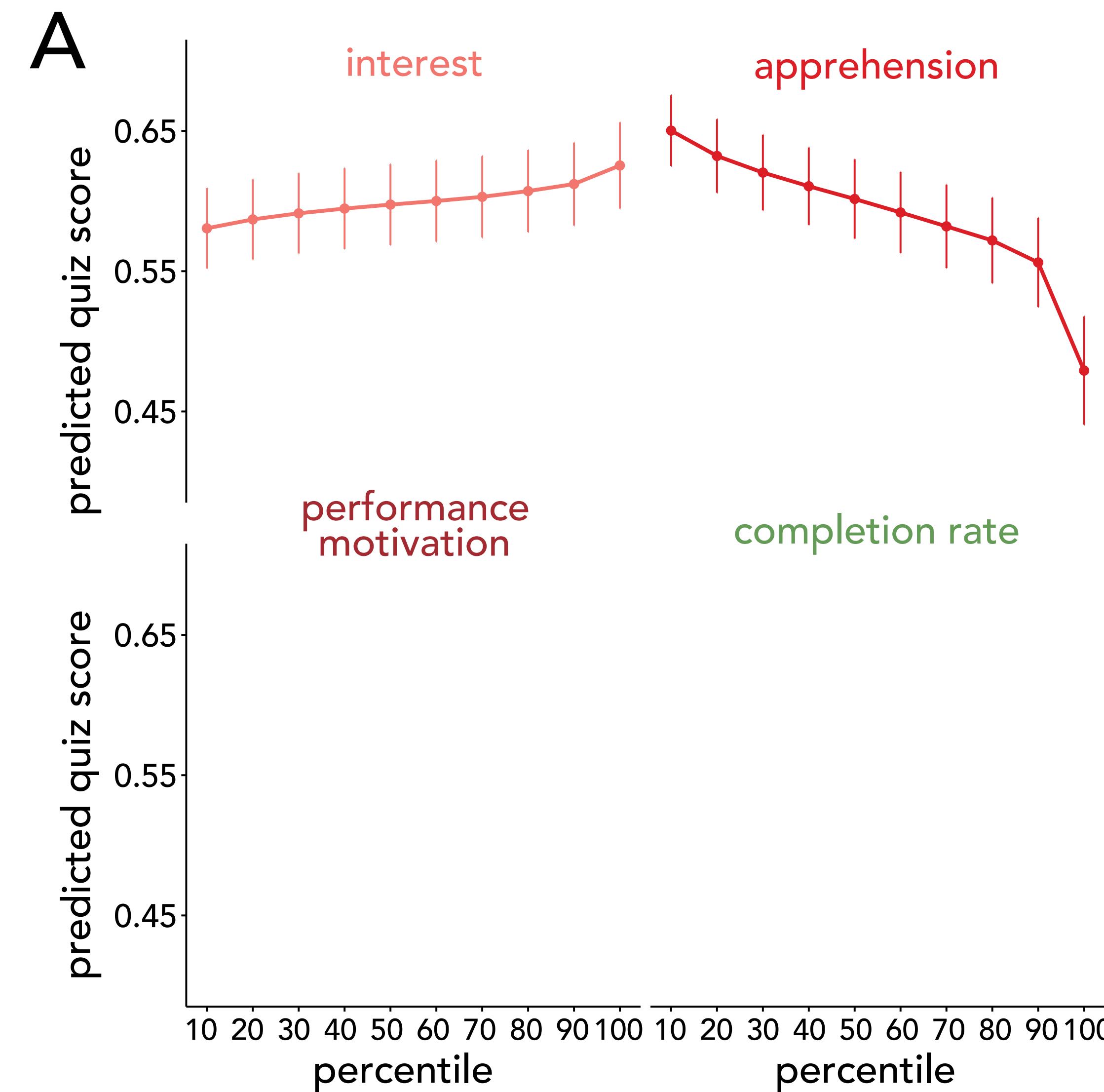
How well do student **attitudes** & **engagement** predict learning?



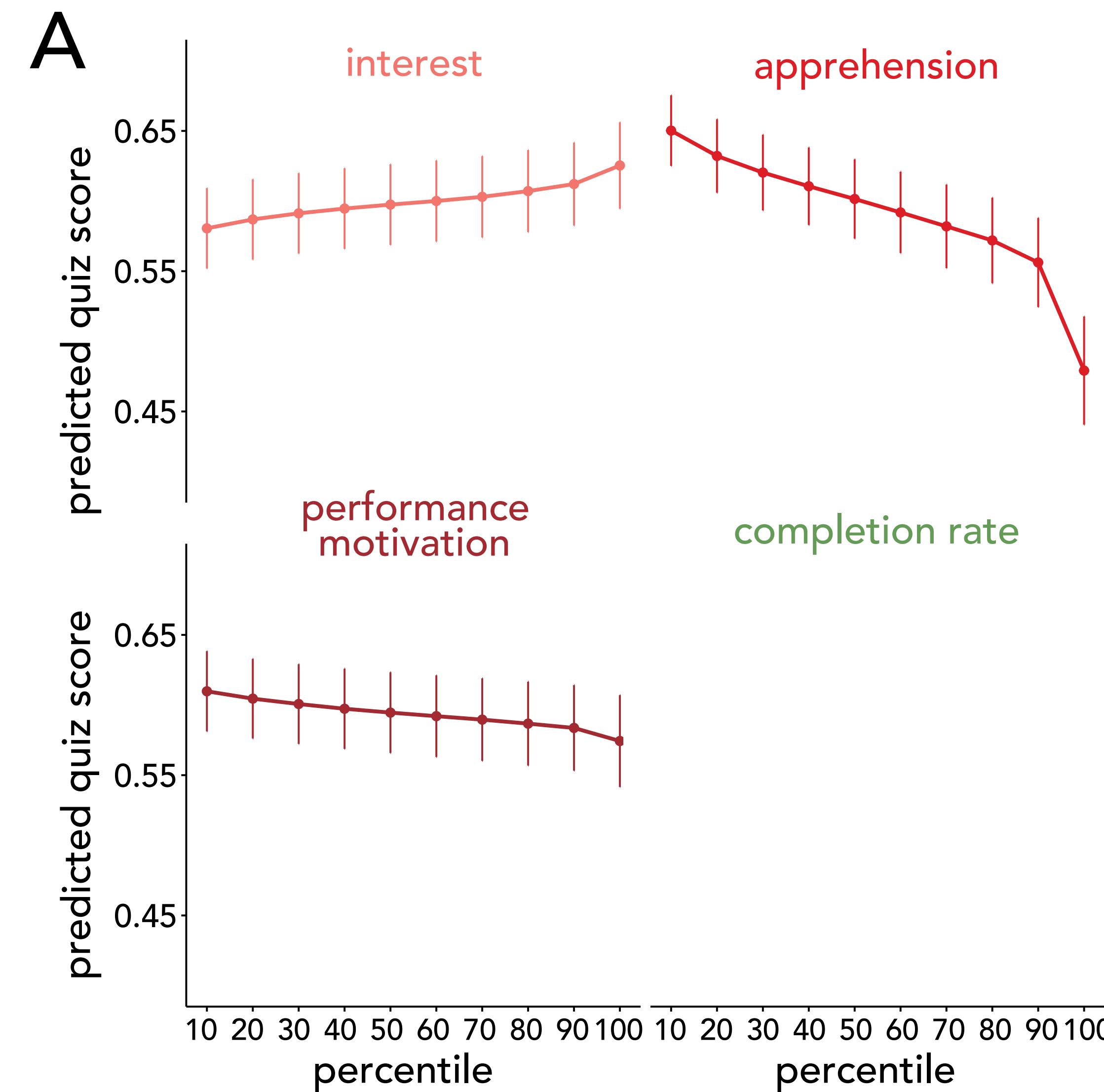
How well do student **attitudes** & **engagement** predict learning?



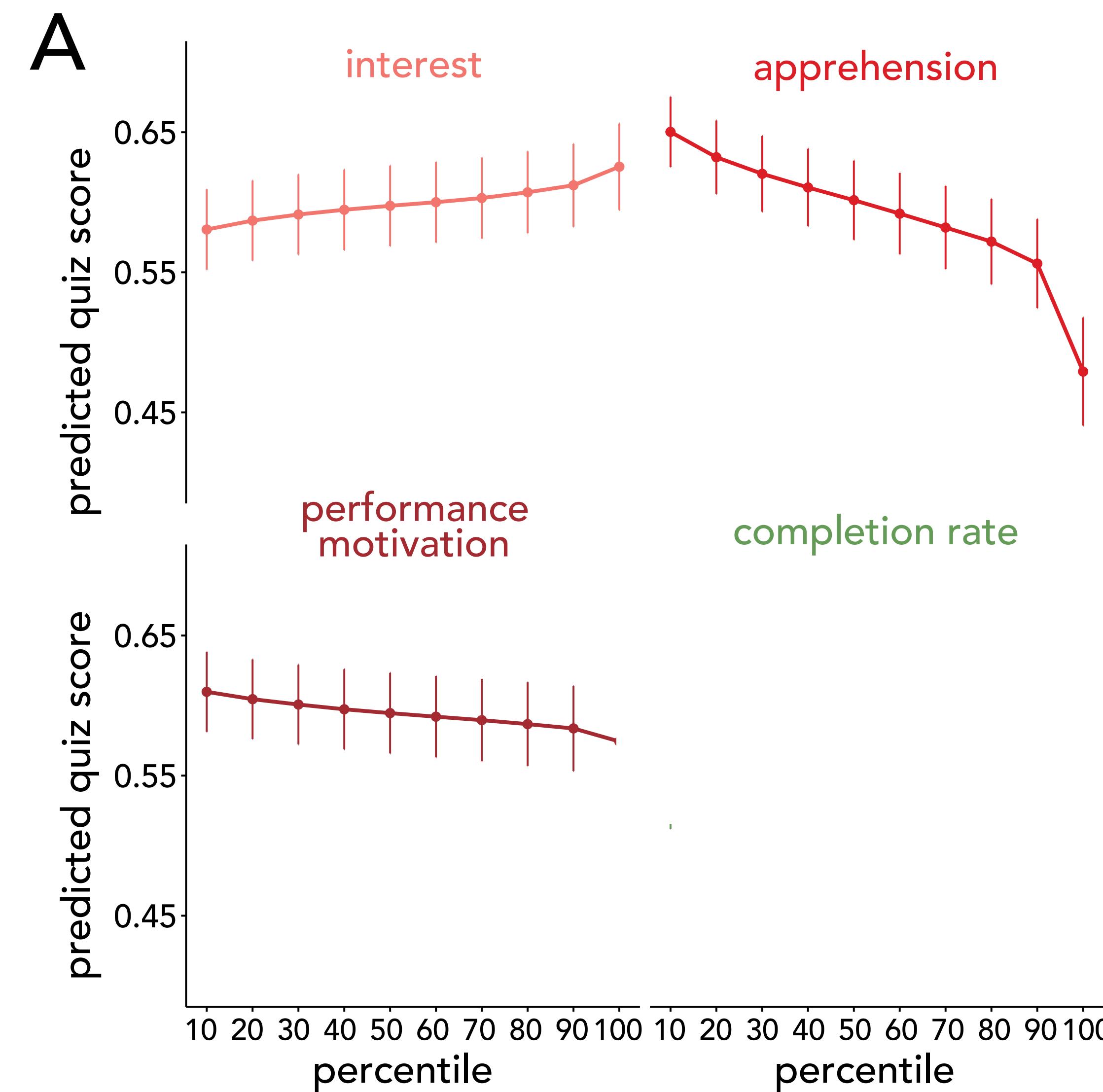
How well do student **attitudes** & **engagement** predict learning?



How well do student **attitudes** & **engagement** predict learning?

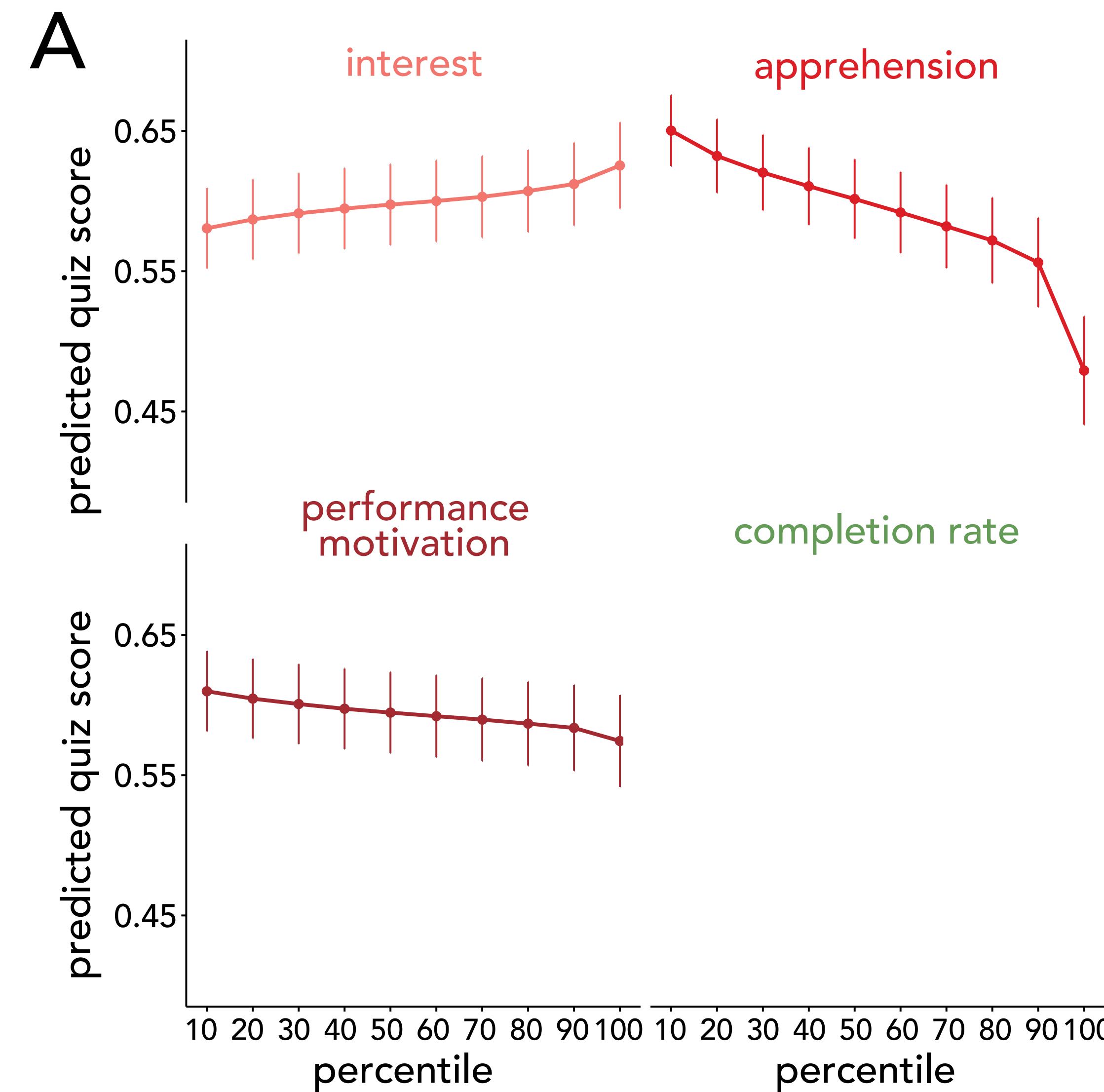


How well do student **attitudes** & **engagement** predict learning?

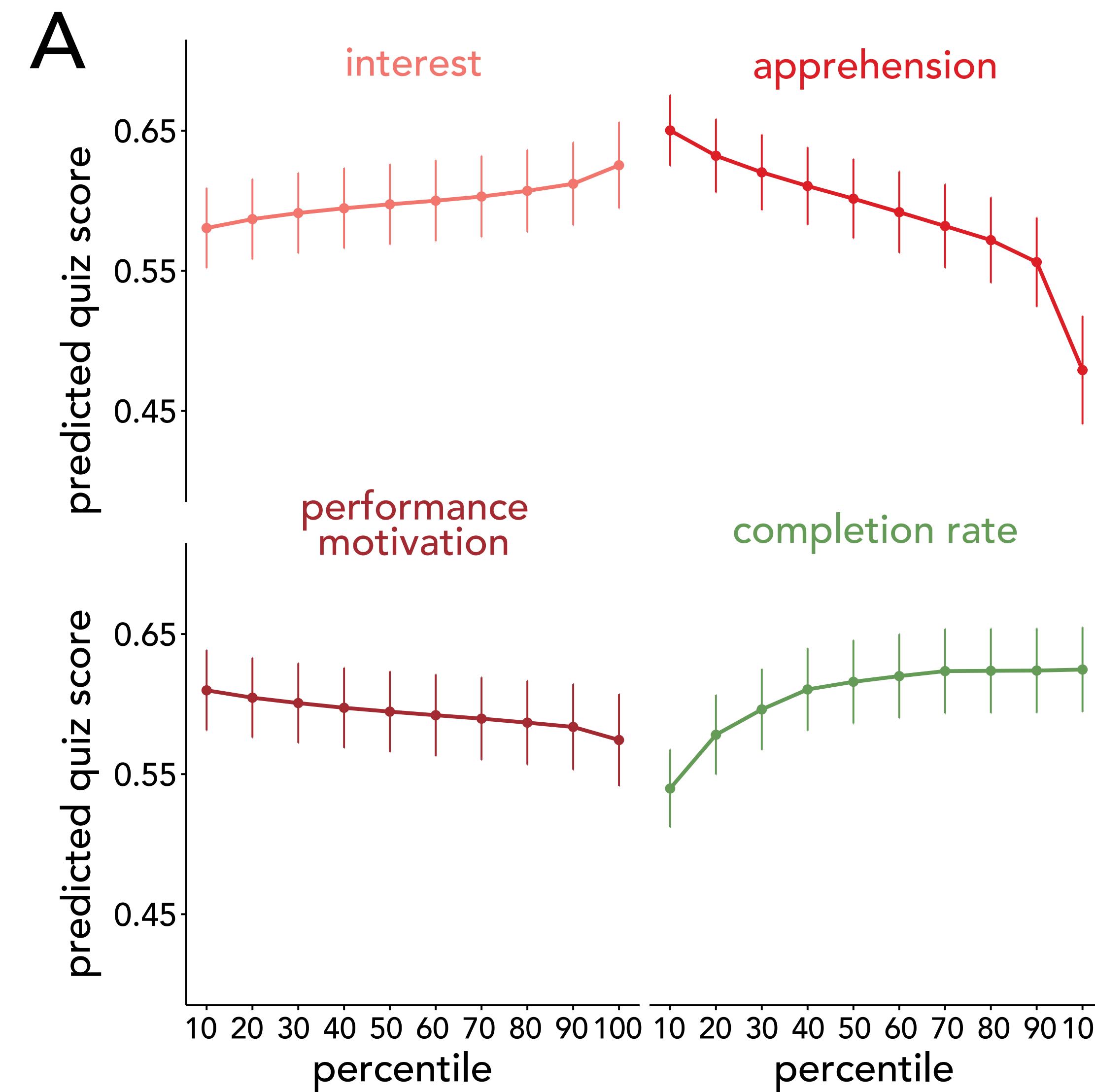


*Initial attitudes predicts
quiz performance*

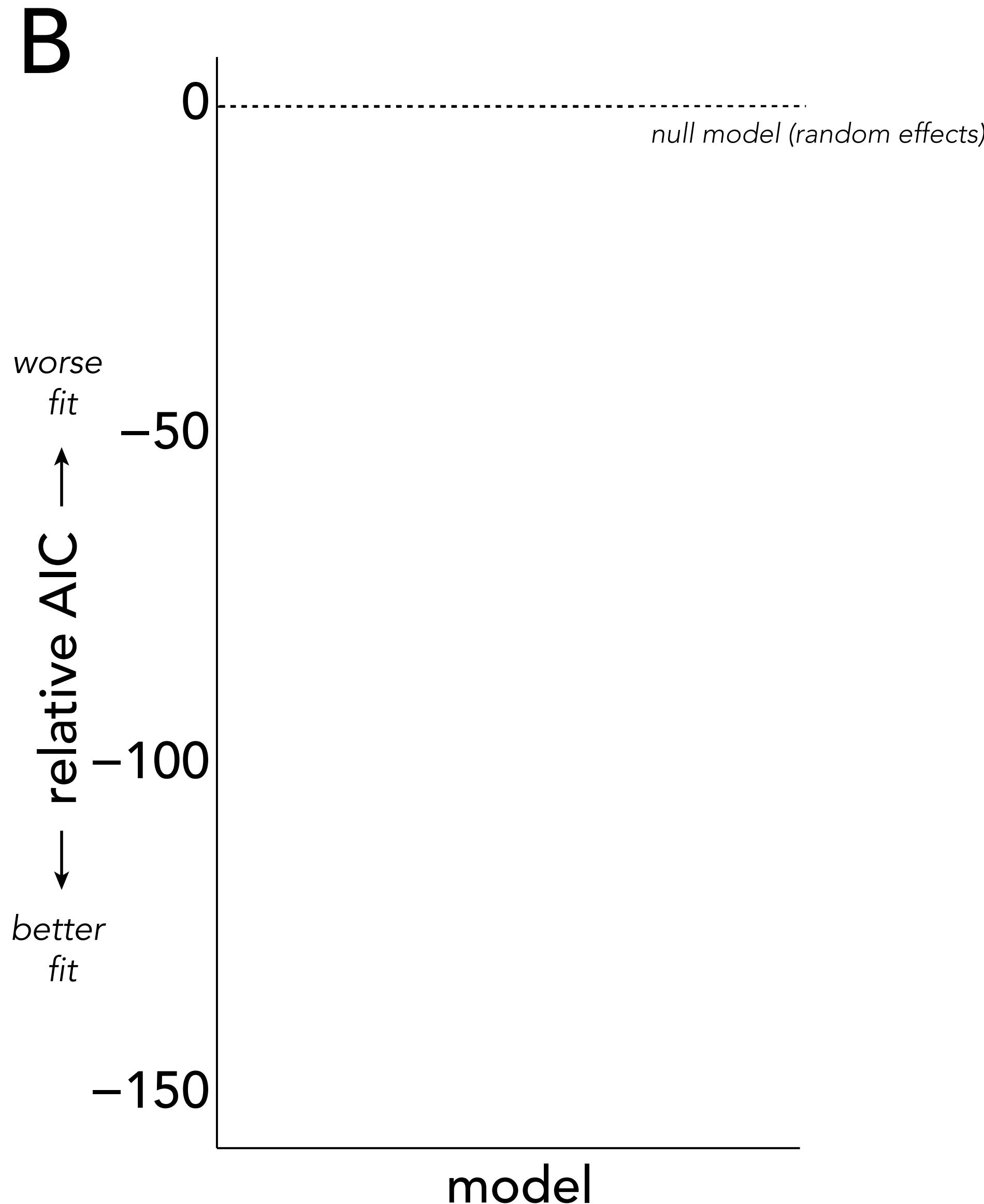
How well do student **attitudes** & **engagement** predict learning?



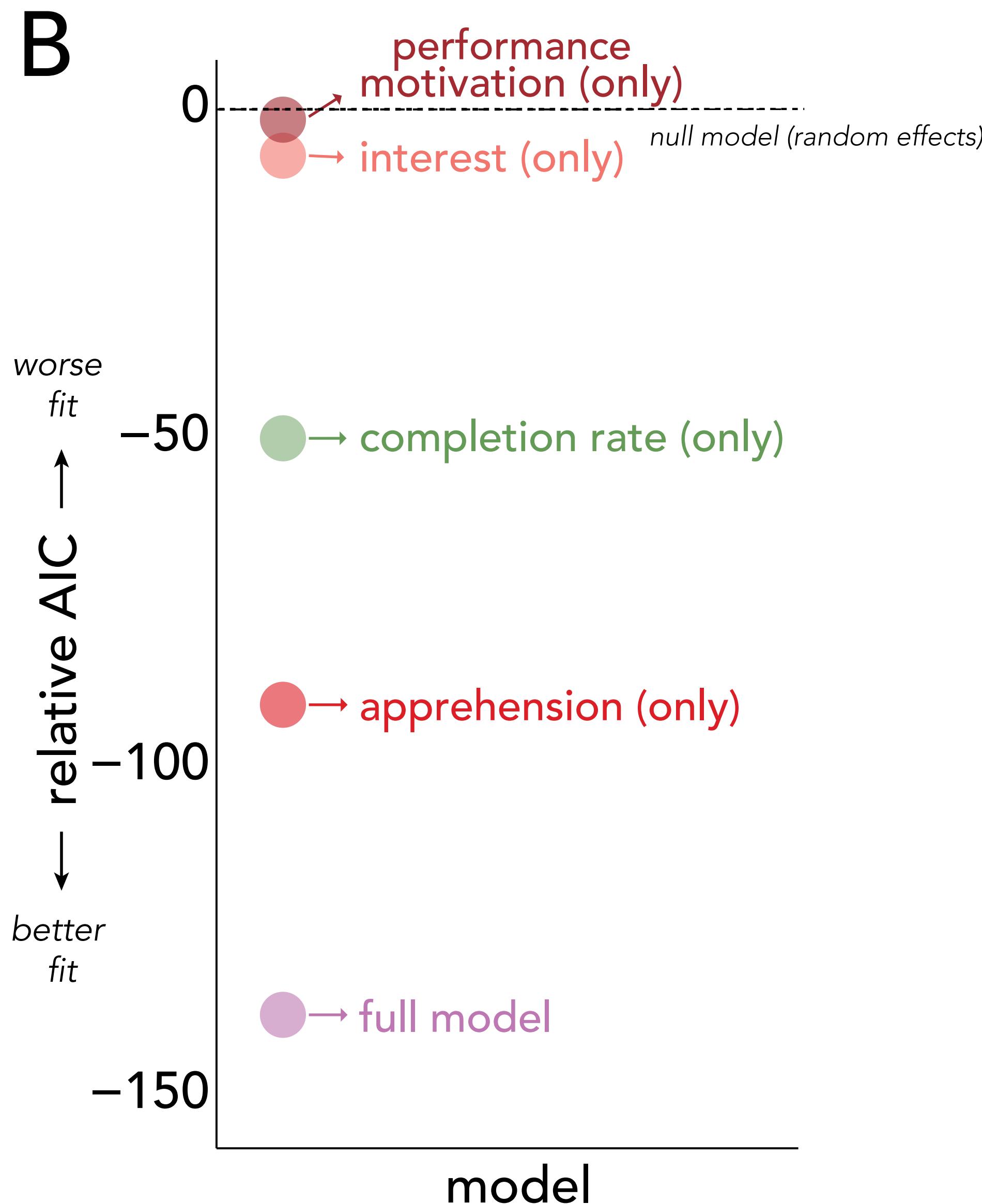
How well do student **attitudes** & **engagement** predict learning?



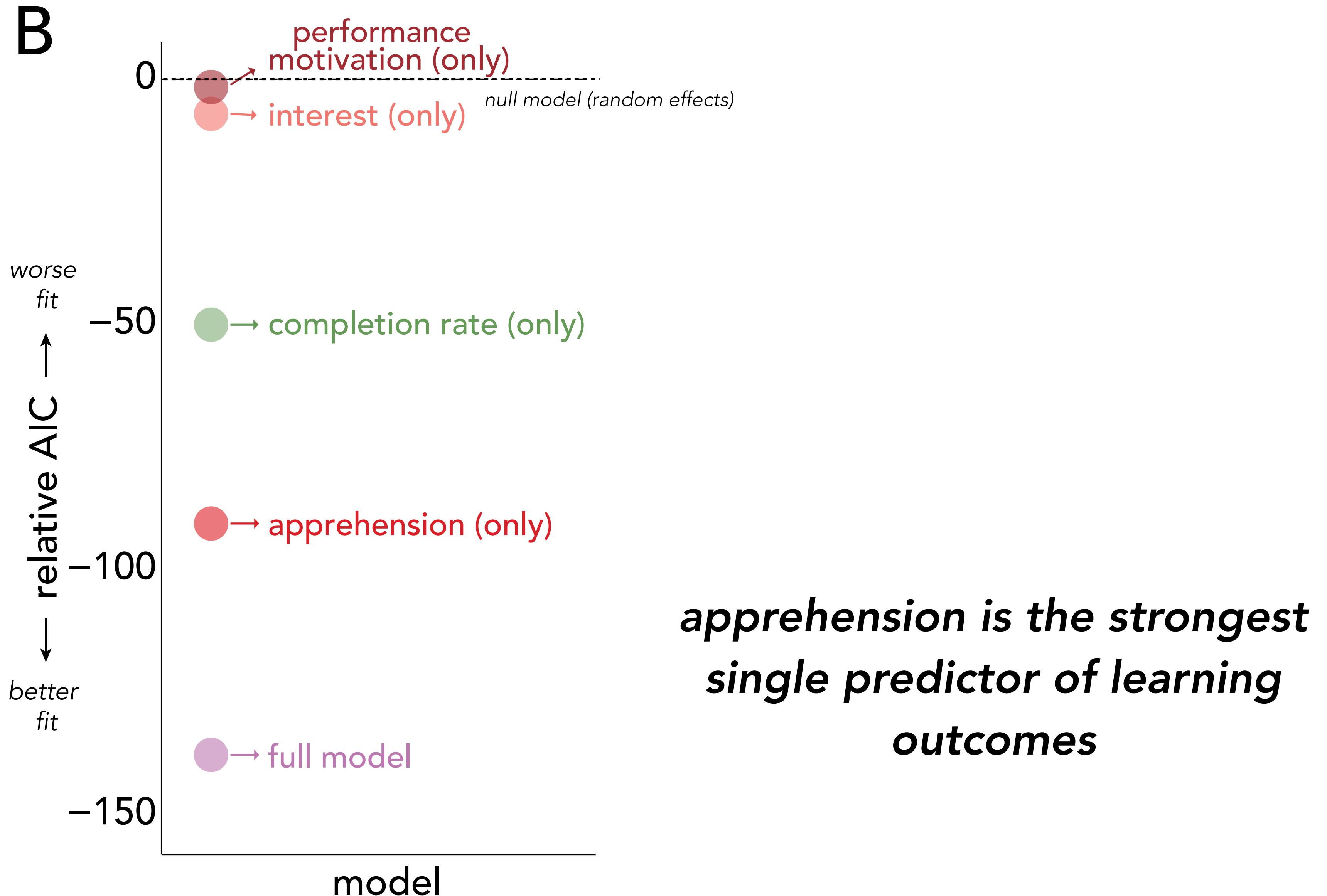
Strength of attitudes & engagement as predictors of learning



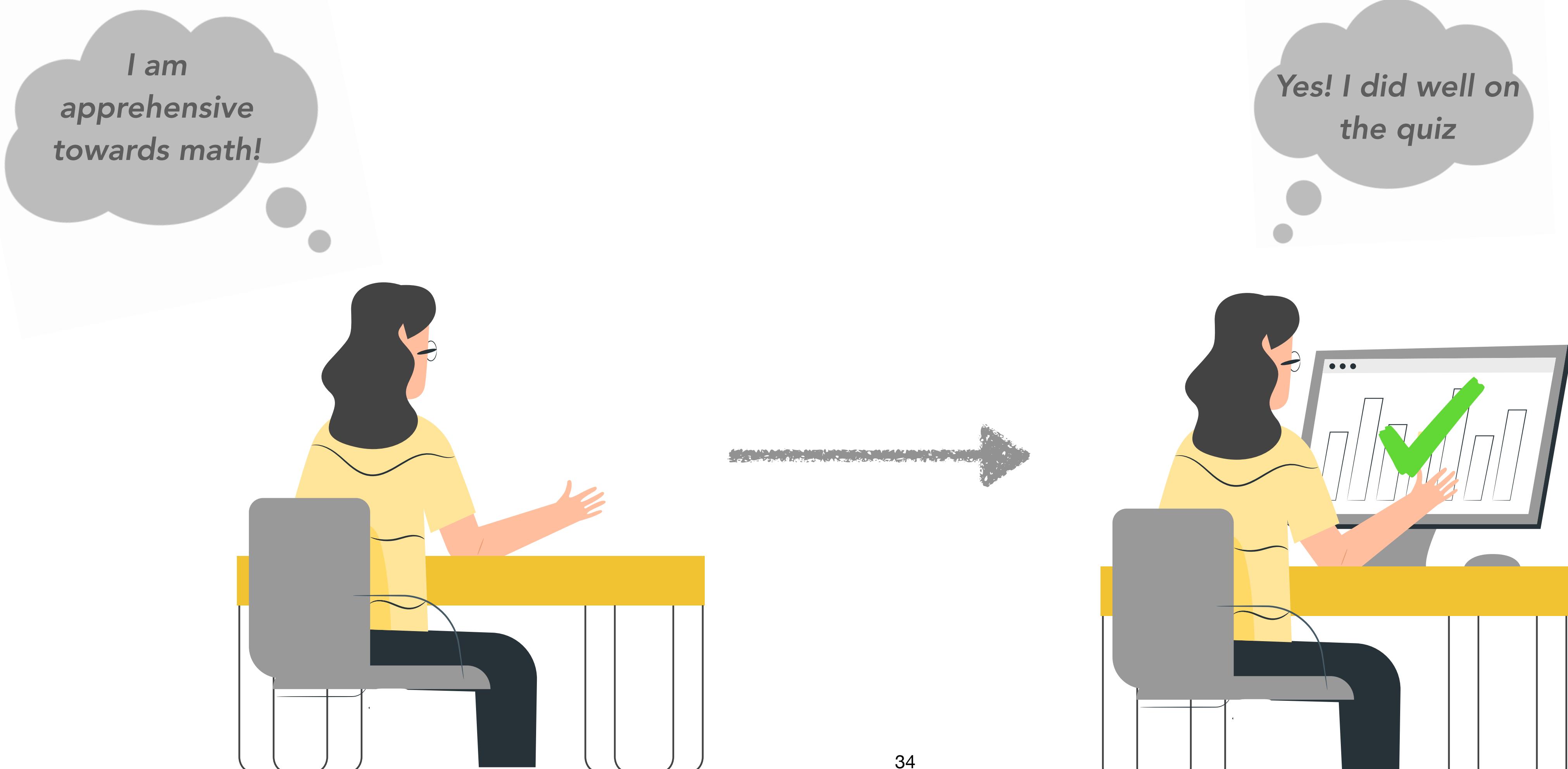
Strength of attitudes & engagement as predictors of learning



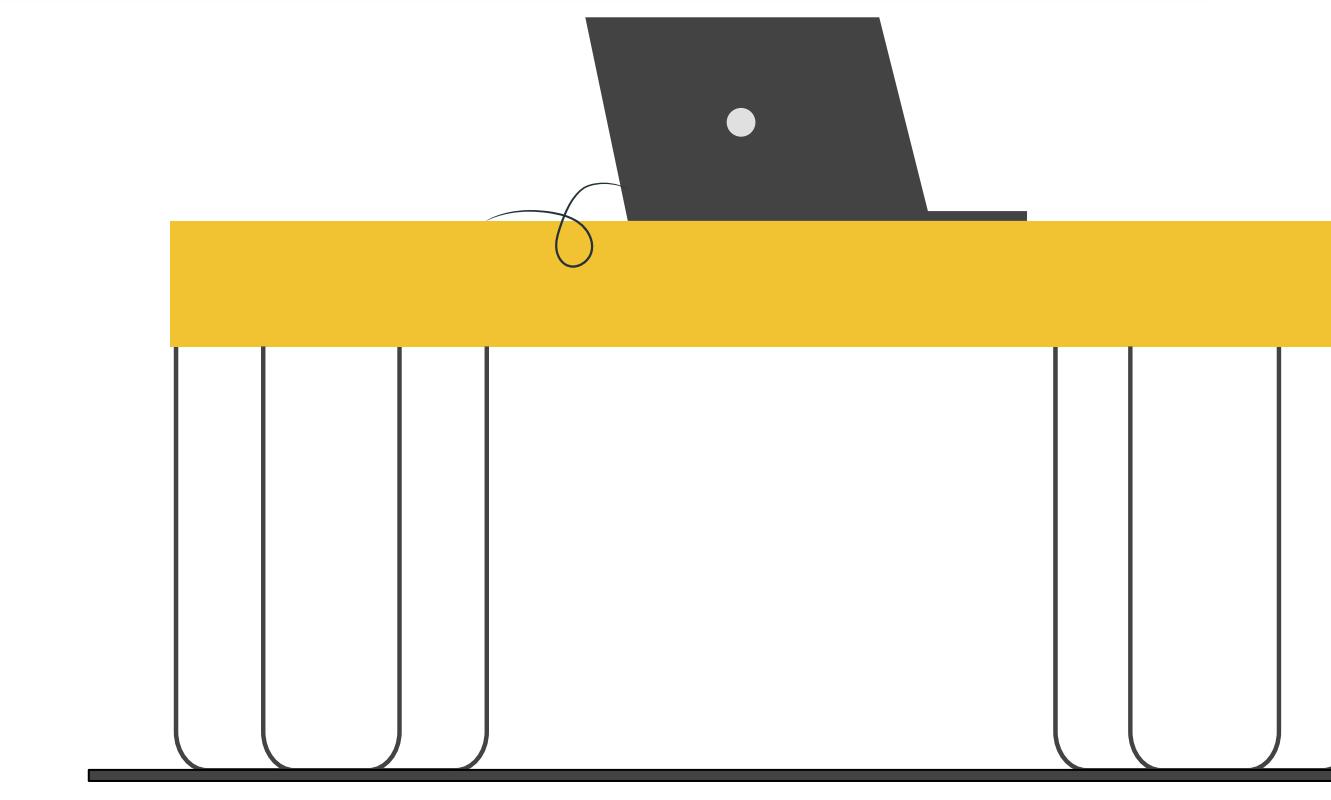
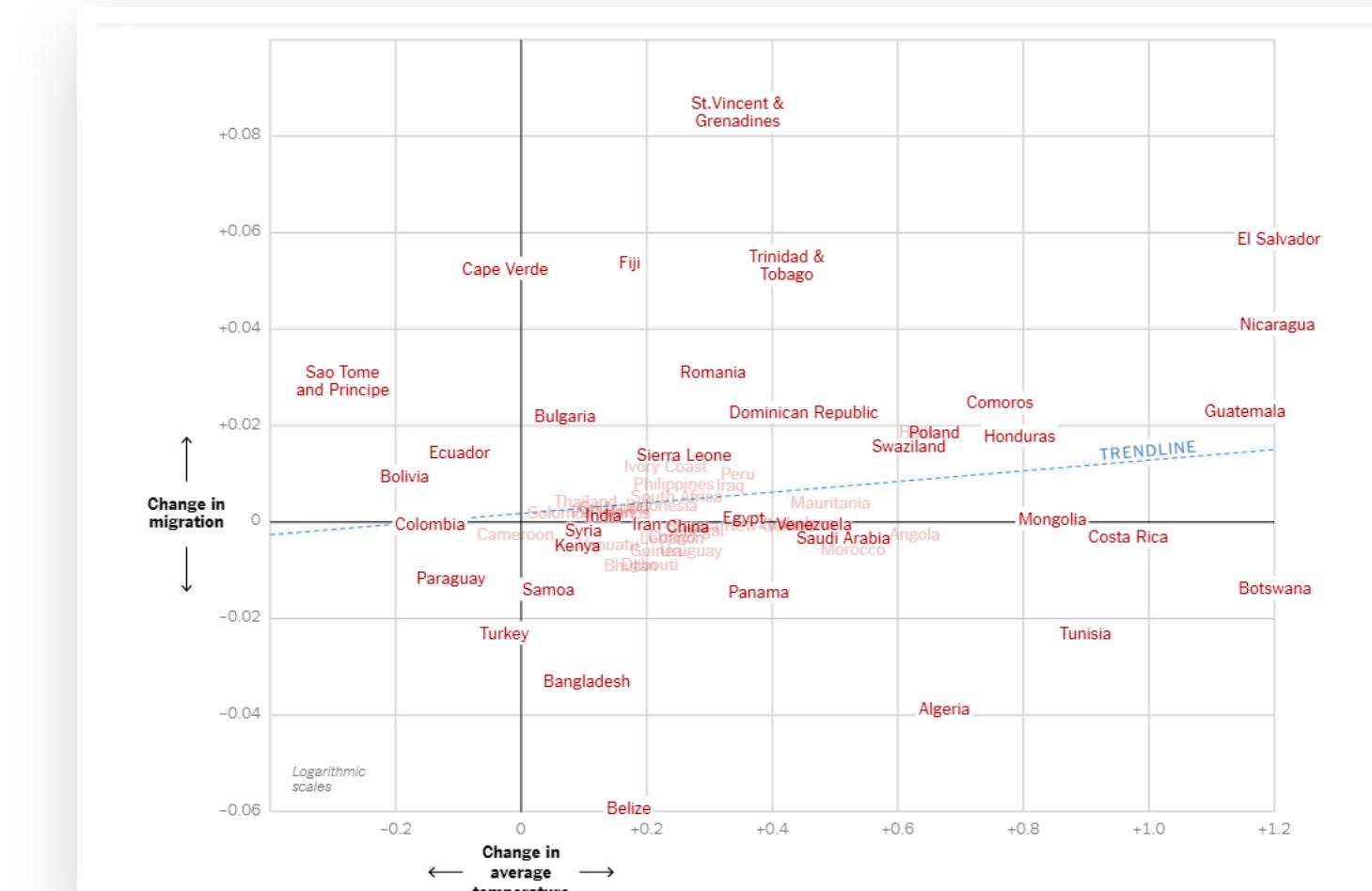
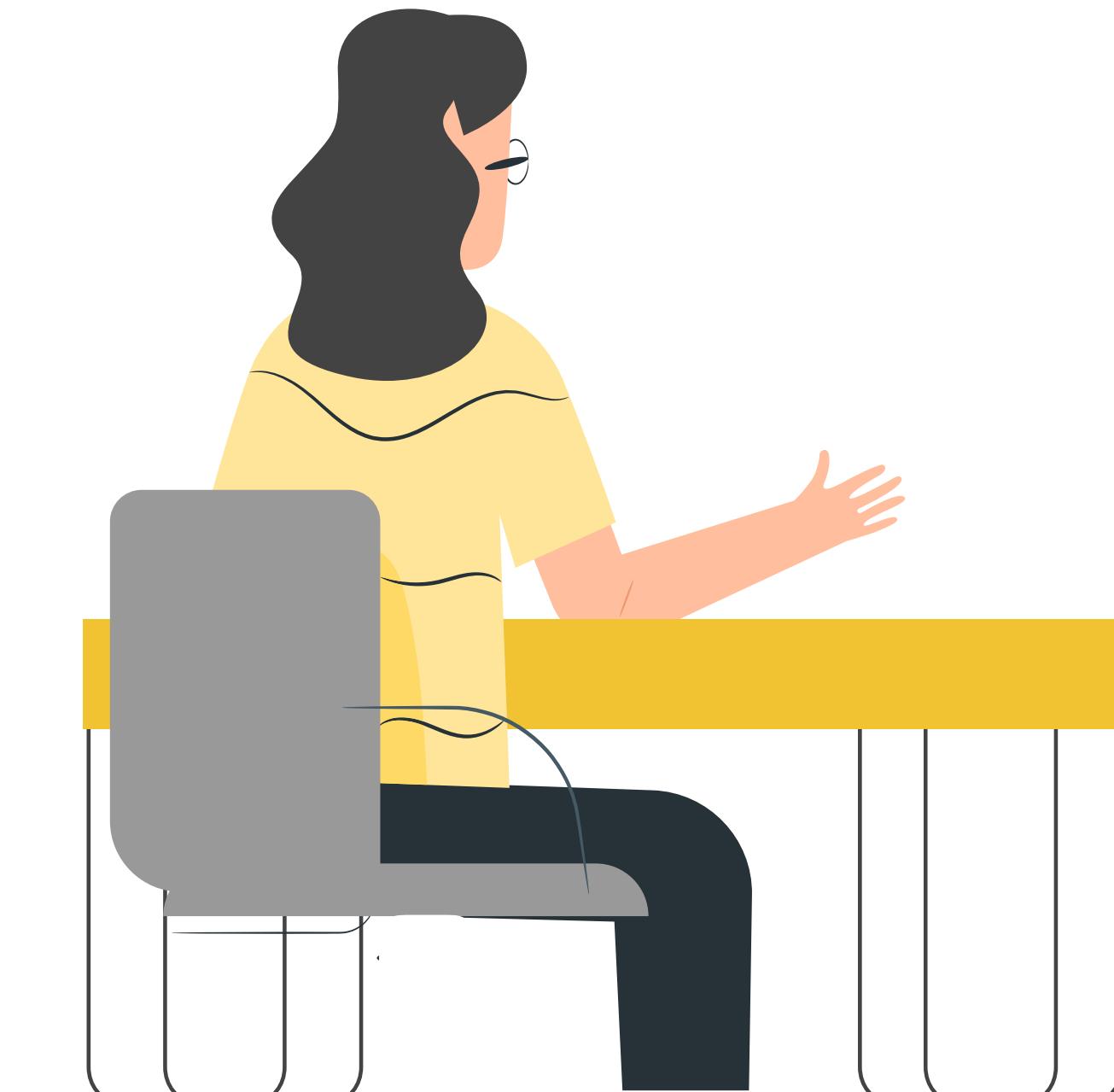
Strength of attitudes & engagement as predictors of learning



Towards interventions for equitable learning in data science courses



Towards interventions for equitable learning in data science courses



Fine-grained measures of students attitude and behaviors can be useful indicators for teachers

Thank you! Questions?



Erik Brockbank



Hannah Lloyd



Zoe Tait



Adam Bear



Soohyun Liao



Judy Fan



cognitive tools lab